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Chapter 4

Contextual Factors Shaping Forest-Poverty Dynamics

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Abstract
Forests and tree-based systems represent complex social-ecological systems. Gaining a better understanding of how contextual factors influence forest-poverty dynamics is essential for the design, targeting and implementation of policy instruments and interventions to alleviate poverty. In this chapter we explore key social, economic, political and environmental factors affecting forest-poverty dynamics, and use a series of illustrative examples to demonstrate how factors can take multiple roles in causal chains of processes of social and environmental change in forest and tree-based systems. We conclude the chapter by highlighting how future research can provide a better understanding of the processes and contexts shaping forest-poverty dynamics, including elucidating the relative effects of different drivers of change on multiple social and environmental outcomes.

4.1 Introduction

Major advances have been made over the past three decades to identify and characterise the socio-economic, political and biophysical processes and conditions that influence forest-poverty dynamics (Geist and Lambin, 2002; Phelps *et al.*, 2009; Meyfroidt *et al.*, 2018; Miller and Hajjar, 2020). In addition to shaping forest-poverty dynamics directly, these processes and conditions create diverse contexts within which policy operates to affect social, economic, and environmental change. Advances in understanding forest-poverty dynamics have been catalysed by the development of theoretical frameworks that enable us to categorise social, economic and environmental systems and their components, and accompanying empirical work to understand how these factors influence the *livelihoods*[6] of *forest-reliant* households and communities. A better understanding of contexts and how they shape change in *forests and tree-based systems* is essential for the design and implementation of forest-based policies and interventions aiming to address *poverty*.

Formerly forested hills in Indonesia converted into agricultural land
Photo © Reem Hajjar

In this chapter, we bring together elements from research strands focusing on land use change, political science, economics and political ecology to identify social, economic, political, and environmental factors (Figure 4.1) operating in forests and tree-based systems that constrain or enable *poverty alleviation*. We also demonstrate how interrelationships among contextual factors can be conceptualised and analysed to better understand how contexts shape forest-poverty dynamics using a series of illustrative examples.

4.2 Frameworks to Contextualise Forest-Poverty Dynamics

Over the past thirty years, scholars have produced various analytical frameworks to understand connections among the multiple components of social, economic, and environmental systems. Notable examples include the Ecosystem Services and Human Well-being framework developed as part of the Millennium Ecosystem Assessment (MEA, 2005), Elinor Ostrom's Social-Ecological System's framework (Ostrom, 2009) and the conceptual framework for the recent Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES 2013). These frameworks highlight linkages between the various dimensions of the natural environment and social, economic, and political systems. Linkages include direct relationships (e.g. *human well-being* benefits derived from provisioning *ecosystem services*), feedback loops linking multiple mechanisms (e.g. relationships among *governance* systems, resource users and *ecosystem* outcomes) and dynamics across temporal and spatial scales. Other frameworks have aimed to describe causal pathways and use overlapping terminologies to disentangle their individual components and mechanisms (e.g. Shaw, 1989; Lüdeke *et al.*, 2004).

6 Throughout this assessment report, all terms that are defined in the glossary are introduced for the first time in a chapter using italics.

Geist and Lambin's (2002) characterisation of *deforestation* drivers, is perhaps the most commonly used classification of socio-economic, political and biophysical factors influencing *forest* cover change, and distinguishes between underlying and proximate causes. Geist and Lambin (2002) define proximate and underlying causes in terms of their position within a causal pathway, with proximate drivers being directly linked to outcomes (e.g. logging) and underlying drivers preceding them (e.g. road construction, which facilitates logging). These frameworks are useful analytical tools to conceptualise and empirically analyse relationships among disparate components of socio-economic, political, and environmental systems. However, they provide insufficient insight to identify potential levers of change (see Chapter 5), and the factors that constrain/enable the efficacy of such levers.

Frameworks derived from causal inference analyses provide additional insight into the relationship among different factors by classifying them as drivers, mediators and moderators to understand and describe causal pathways within a system (Ferraro and Hanauer, 2014a). In this context, 'mediators' are defined as the mechanisms or intermediate steps through which drivers (and potential levers of change) exert their effect (Figure 4.1). In contrast, 'moderators' act as contextual processes and conditions that influence the magnitude of the effect that a driver can exert (Figure 4.1).

Social, economic, political, and environmental factors are often missing from analyses of forest-poverty dynamics (see Chapter 2), but are important because they provide some of the spatial, temporal and contextual elements shaping both forest-poverty dynamics as well as potential levers of change. Furthermore, social, economic, political, and environmental factors can act as any of drivers, mediators, moderators or outcomes (see Figures 4.2. and 4.3.). These factors may simultaneously operate as drivers, mediators, moderators and outcomes: their respective position within causal chains is specific to the analysis being conducted (see Box 4.1 for examples).

The factors that we present in this chapter were jointly identified through literature reviews by the chapter authors and iteratively discussed over multiple meetings. They are classified as relating to the social, economic, political and policy, and environmental contexts which all influence the forest-poverty relationship. Our aim in this chapter is to present a wide range of key social, economic, political, and environmental factors that have influenced, and are likely to continue to influence, forest-poverty dynamics over short and long time horizons. In so doing, we also demonstrate how some of these factors can simultaneously operate as drivers, mediators and moderators in forests and tree-based systems using a handful of illustrative examples in Box 4.1. Given the changing and contested nature of forest-poverty dynamics, our list of factors is not likely exhaustive. However, the factors presented here are broadly discussed in the literature and are key to understanding potential variation in forests-poverty dynamics in diverse settings around the world.

The categorisation and ordering of these factors into social, economic, political, and environmental contexts is but one way of organising them. We recognise that factors often straddle multiple contexts. Furthermore, social, economic, political, and environmental contexts (and the multiple factors within them) are not independent from each other: they often co-occur in space and time, and interact in multiple complex ways (Figure 4.1). Our empirical understanding of how these contexts and factors work together to shape forest-poverty dynamics still remains limited due to analytical limitations (see Chapter 2 and Section 4.7). By using the illustrative examples in Box 4.1 we aim to provide a better analytical perspective of how social, economic, political, and biophysical contexts and factors can shape forest-poverty dynamics, and influence levers of change.

4.3 Social Context

Large-scale social factors are key determinants of local forest-poverty dynamics. These factors can originate outside forests and tree-based systems and may operate at national or international scales (e.g. migration), exert influence at more localised scales (e.g. population dynamics), and be intrinsic to individuals, communities or societies (e.g. identity and culture). Feedback loops signify that these factors both shape and are shaped by the social context within which they take place; they may shape local forest-poverty dynamics through national-level policies that are often implemented at sub-national levels. More intrinsic characteristics and elements, such as identity, culture, social capital and associated local norms, have profound implications for livelihoods and forest-use.

4.3.1 Population dynamics and consumption

Population growth and density have often been considered key factors influencing deforestation because of increased local pressure to convert land to agricultural production, and because of

Figure **4.1**

Social, economic, political, and environmental contexts and factors influencing forest-poverty dynamics

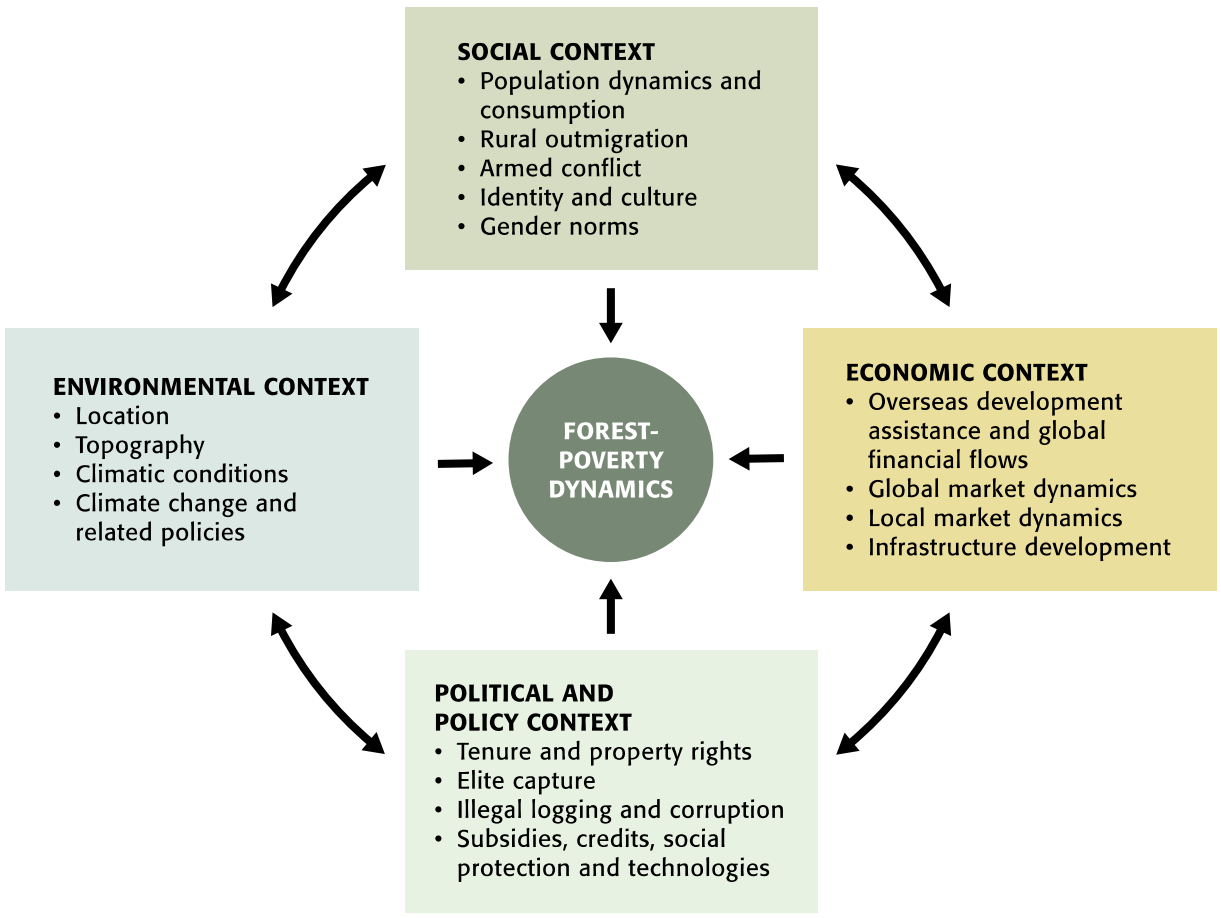
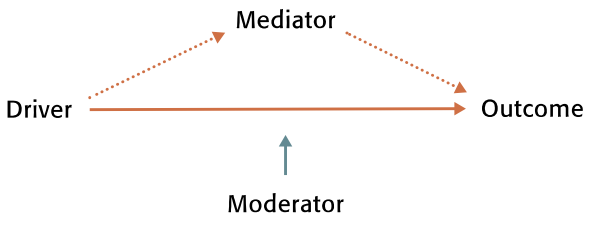


Figure **4.2**

Causal chain linking drivers, mediators, moderators and outcomes



Source: Ferraro and Hanauer, 2014

the increased demand for forest products. Agricultural expansion and associated deforestation patterns between the 1960s and 1980s were often linked to state-sponsored agricultural frontier colonisation programmes and land reforms in Latin America and Southeast Asia (Rudel *et al.*, 2009). This pattern is well exemplified by the demographic dynamics in the Brazilian Amazon that followed the National Integration Plan and the associated Transamazon Highway Colonisation Scheme (Moran, 1990).

The historical link between population growth, population density and deforestation has weakened. Rural populations globally have substantially declined over the past decades (World Bank, 2020). In their synthesis of 152 sub-national case studies Geist and Lambin (2002) found that increases in population due to fertility rates in forest areas was not a primary driver of deforestation (Geist and Lambin, 2002). While smallholder agriculture continues to be a driver of deforestation (Godar *et al.*, 2014), most tropical deforestation and associated *biodiversity* loss in recent decades have been driven by well-resourced farmers, ranchers and loggers as well as international agricultural corporations meeting consumer culture and market demands for timber, soy, beef and palm oil, much of it in high- and middle-income countries (Henders *et al.*, 2015; Green *et al.*, 2019; see Chapter 6).

Population shifts from rural areas to urban population centres, and the rise of the middle classes in lower- and middle-income countries have created new urban demands (African Development Bank, 2019). These demands have been linked to deforestation (DeFries *et al.*, 2010) and have been predominantly met by large industrial agricultural projects (Davis *et al.*, 2020). Critically, large-scale agricultural investments and land transactions, often termed 'land grabs', have been linked to multiple negative outcomes for rural and *forest-dependent* communities, including forced displacement and resettlements, and loss of access to land, resources and livelihoods (Agrawal *et al.*, 2019; Hajjar *et al.*, 2020).

4.3.2 Rural outmigration

Outmigration from rural areas represents one of the most important changes in population dynamics globally in recent decades (Hecht *et al.*, 2015; World Bank, 2020). Rural outmigration has been shown to have multiple and complex effects on forests and forest livelihoods. For example, outmigration in Nepal rose from near zero in 1980 to 29% in 2010 and has been a key driver of *reforestation* and poverty alleviation (Fox, 2018; Oldekop *et al.*, 2018), with remittances accounting for 26% of Nepal's gross domestic product (GDP) in 2019 (World Bank, 2020). We explore how rural outmigration can act as a moderator of *policy instruments*, as well as a driver of change in forests and tree-based systems in Box 4.1.

The effects of outmigration vary significantly at the household level (Sunam, 2017), and long-term development outcomes of outmigration in places of origin remain unclear (de Haas, 2010; Oldekop *et al.*, 2018). The notion that outmigration of male community members increases women's participation in *forest management* decisions is also debated (Giri and Darnhofer, 2010; Lama *et al.*, 2017; Prateek *et al.*, 2019). While remittances may reduce household dependence on agriculture and forests resources and help to diversify income sources (Hunter *et al.*, 2015), outmigration has also been linked to labour shortages and the weakening of community management institutions and the capacity for sound decision-making through a reduction in social capital (Robson and Nayak, 2010; Poudel, 2019). Migration effects also depend on whether migration is seasonal, national or international, with seasonal and national migrants often retaining close links to areas of origin, and international migrants sending larger remittances (Davis *et al.*, 2010). Remittance effects also appear to be context dependent, with evidence suggesting that remittances may be invested to switch to less labour intensive and land extensive agricultural systems, such as cattle ranching in some South American countries (Garcia-Barrios *et al.*, 2009). These investments and changes in production systems can deepen rural inequalities and increase deforestation as wealthier landowners consolidate landholdings, and clear additional tracts of forest as part of their agricultural expansion activities (VanWey *et al.*, 2012; Alix-Garcia *et al.*, 2013; Davis and López-Carr, 2014; Taylor *et al.*, 2016).

The 2020 COVID-19 pandemic has heavily impacted migration flows and remittances, and in many countries has driven the return migration of thousands of people to rural areas. The effects that these new migration dynamics will have on incomes, livelihoods and forests remain to be seen.

4.3.3 Armed conflict

Armed conflict and forest-poverty dynamics are interlinked in many contexts across the globe (Brainard and Chollet, 2007). Geography and poverty are both significant predictors of conflict intensity (Do and Iyer, 2010). For example, 80% of armed conflicts in recent history have occurred in biodiversity hotspots, many of them tropical for-

est regions (Ordway, 2015), leading some to speculate that violent conflicts are endemic to forests (Chomitz *et al.*, 2007). Conflict-related deaths are significantly higher in poorer districts and in geographical locations favoured by insurgent groups, such as mountains and forests, as they enable insurgents to hide easily from government forces (Do and Iyer, 2010).

Poverty is both a cause of insecurity and a consequence of it (Brainard and Chollet, 2007). The lack of economic opportunities is significantly and robustly correlated with a higher intensity of violence (Do and Iyer, 2010). Communities often fall into vicious cycles of conflict, environmental degradation and poverty, leading to what Brookings scholar Susan Rice calls a "doom spiral" that may be nearly impossible to overcome without outside aid (Brainard and Chollet, 2007; Bob and Bronkhorst, 2010).

Although literature explicitly untangling the connections between forests, poverty and conflict is scarce, three key linkages have been identified. First, conflict and warfare can drive deforestation (Ordway, 2015). Insurgent groups in forests frequently destroy forests during violent clashes, cleared for military purposes, and felled for valuable resources such as "conflict timber" to fund and sustain conflict (Harwell, 2011; Kleinschmit *et al.*, 2016). Forests are vital sources of refuge and emergency subsistence for both local and displaced peoples (Harwell, 2011), yet forest-dwellers frequently experience violence, displacement and livelihood insecurity as a result of conflict, leading to increased levels of poverty, malnutrition, illness and death (Buvinic *et al.*, 2013). Massive migrations of internally displaced peoples can also result in a redistribution of pressure on forests in settlement regions (Ordway, 2015). Second, conflict may lead to the active exclusion of activities from certain geographic regions, favouring forest recovery in what has been referred to as war zone refugia or 'gunpoint conservation' (Ordway, 2015). As agricultural fields are abandoned and wood extraction is hindered, forests are able to recover (Kaimowitz, 2006; Sánchez-Cuervo and Aide, 2013). Third, conflicts may lead to the collapse of institutions (Ordway, 2015). Extreme poverty exhausts governing institutions and depletes resources, fuelling a volatile mix of desperation and instability (Brainard and Chollet, 2007). Weakened institutions, plagued by ineffective governance, are unable to meet people's basic needs or to allow them to control their territory, leaving lawless areas and natural resources vulnerable to hijacking by predatory actors (Brainard and Chollet, 2007).

Post-conflict processes see governments prioritising socio-economic recovery, peacekeeping and *poverty reduction* (Pérez and Garzón, 2015) over natural resource management and environmental sustainability. Recognition that natural resources can be an opportunity and a challenge for peace has led international peacekeepers to intervene in post-conflict countries to establish governance reforms that promote sustainable peace and development (Beevers, 2015).

4.3.4 Identity and culture

Identity politics have strong links to forest conservation, rural livelihoods, and poverty. Anthias and Radcliffe (2015) use the term 'ethno-environmental fix', Adam (2010) and Hall *et al.* (2011) use the terms 'ethnoterritorialization' and 'ethnoterritorial claims' to show how identity is used to exclude others from forest titles and lay territorial claim based on ethnicity. Some governments use these ethnicity-based communal titling to retain territorial control while giving local people the illusion of self-government (Tubbeh and Zimmerer, 2019).

The history of forest use, governance, and dependence has been intrinsically linked with the making of a 'forest subject' (Li, 2010). Forest dwelling people have often been cast as non-market subjects who are dependent on the forest for subsistence and, therefore, needing to be protected from the market and micro-economic processes (Li, 2014). States have often used this identity of the non-market, subsistence-based forest dwellers to deny them ownership of land and assets (Li, 2014). Forest residents who are denied these rights may find their labour used in resource extraction efforts, such as timber operations (Münster, 2014). The lack of access to the market and land has 'arborealised' people, making them further dependent on the forests for such products as fruits, resins, tubers and fuelwood and, in some cases, *swidden* agriculture to meet their food needs (Walker, 2004). This has produced an identity of rural people as being 'ecosystem people' or 'living in harmony with the forest' (Gadgil and Guha, 1992). Such an identity has thus been 'fixed' in current forest governance narratives despite mounting evidence of their historical connections with markets and agrarian society. Although most governance regimes tend to simplify the community for ease of interventions, the 'community' is not homogeneous (Agrawal and Gibson, 1999). At the same time, the creation of an indigenous identity for forest dwellers might divide them and prevent them from making stronger claims for a redistributive regime (Shah, 2010).

Forest-dwellers obtain most of their daily resources from their immediate surroundings. Here, an ethnic Chakma woman stands in front of her house, Chittagong, Bangladesh
Photo © Terry Sunderland

4.3.5 Gender norms

Participation in forest usage and decision-making is largely determined by societal rules, norms, and perceptions, including those pertaining to gender. Predicated on gender norms and rules –especially the division of labour and economic endowment – women and men differ in the nature and extent of their reliance on, and use of, forests (Agarwal, 2009). Such norms shape the role of men and women, what they are expected to do or not to do, their preferences in terms of forest products, their knowledge of forests, and ultimately, the ability to use and protect forests.

Since agriculture and forests provide an essential resource to livelihoods in many parts of the world, including sub-Saharan Africa, South Asia, and Southeast Asia, gender patterns of work also play a crucial role in poverty reduction and food security (FAO, 2010; Mudege *et al.*, 2017). *Pathways out of poverty* differ for men and women as they require different types of interventions depending on their reliance on forests and resource usage (Cheng *et al.*, 2019).

Gendered patterns of participatory exclusion in resource access and decision-making persist in many contexts around the world due to the lower bargaining power women have based on pre-existing socio-economic inequalities and relations of power (Agarwal, 2001; Badola and Hussain, 2003; Deda and Rubian, 2004). Often, societal norms define women's role as centred around domestic work and childcare, and societal perceptions discount women's abilities and opinions (Agarwal, 2001). However, opportunities for effective participation are important as a measure of citizenship and a means of empowerment, as well as for *equity*, efficiency, and sustainability of resource usage (Agarwal, 2001). For example, land is a key determinant of production and central to agricultural and economic development in developing countries, but women are less likely to own land compared to their male counterparts (Kiptot *et al.*, 2014). Even where the law might grant equal land ownership and inheritance rights, customary laws often bar women from land ownership. Research in African contexts has also shown that women have less access than men to productive resources and opportunities such as labour, education, extension, financial services, and technology (Kiptot *et al.*, 2014). Likewise, women in Nepal and India are often excluded from decision-making consultations and training related to community forest management, resulting in the exclusion of

The lack of resources creates harsh living conditions in the mountains of Nepal
Photo © Nelson Grima

their existing knowledge in forestry programmes, and women having less chance of acquiring new knowledge (Agarwal, 2001). Such unequal distribution of access and benefits of resources further worsen women's plight, particularly in already poor households.

4.4 Economic Context

Economic factors shaping social and environmental change in forests and tree-based systems reflect multiple political, financial and market-related processes. Typically, economic and political forces originate outside forests and tree-based systems and represent contexts shaped primarily by external actors and institutions, including international markets and international agreements. Important economic factors include overseas development assistance and global financial flows, global and local market dynamics, and investments in infrastructure that facilitate the movement of goods and people.

4.4.1 Overseas development assistance and global financial flows

Global financial flows are key drivers of forest cover and poverty dynamics (Meyfroidt *et al.*, 2013; Folke *et al.*, 2019). Key flows include overseas development assistance (ODA), export credits, and tax avoidance and evasion.

An estimated USD 70 to 160 billion annually is needed to sustainably manage the world's forests (World Bank, 2014). Financial estimates for the effective conservation of biodiversity, much of which resides in forests in *low- and middle-income countries* (LMICs), are of a similar magnitude, ranging between USD 76 to 440 billion per year (McCarthy *et al.*, 2012; Drutschinin and Ockenden, 2015). However, since 2014 only USD 7 billion in international aid has been allocated to forest-related projects. To assess recent trends in forest aid, we collated a dataset on funding to all forest and tree-related projects from the databases of major aid organisations (e.g. GEF, OECD, World Bank) using keywords (such as 'forest', '*agroforestry*', 'deforestation', 'tree'). Furthermore, many ODA disbursements often support actors that favour the extraction of natural resources, which may conflict with forest resource conservation aims.

Export credits to businesses are an important source of loans for LMICs, and are managed by government agencies, private sector bodies or a mixture of the two. Loans are often tied to business contracts with favoured companies in lending countries (Clapp and Dauvergne, 2011). Evidence suggests that such forest developments have often disregarded the traditional lands and forests claimed by indigenous peoples and communities and, in the process, undermined local

livelihoods. For example, Asia Pulp and Paper, the holding company for the interests in pulp and paper of Sinar Mas, a major Indonesian business, has been implicated in various deforestation scandals, despite formal commitments to sustainability (Jacobson, 2018).

Tax avoidance (through the use of legal loopholes) and tax evasion (through the use of illegal loopholes) deprive states of funds that could be applied for a range of social and environmental measures (Global Financial Integrity, 2019). The financial secrecy surrounding tax havens makes it difficult to track the money that flows through them and to hold financiers accountable for the environmental and social consequences of their investments (Galaz *et al.*, 2018). However, although estimates are difficult to come by, money channelled through offshore tax havens has been used to finance deforestation that impoverishes communities (Galaz *et al.*, 2018).

4.4.2 Global market dynamics

Global production and trade of principal wood-based products recorded their highest ever values in 2018 (FAO, 2019). This provides forest-dependent people with increased opportunities for the marketing of forest products. However, many marginal communities require technical assistance for post-harvest processing, and stronger support to facilitate market integration, strengthen bargaining power, and access to technology and credit (Belcher, 2005).

Unlike agricultural markets where the advance of voluntary sustainability standards, such as organic, Fairtrade or Rainforest Alliance/UTZ certification, has allowed smallholder farmers to strengthen their position in global value chains (Potts, 2018), international markets for forest products tend to offer less opportunities for resource-poor people to differentiate their offer of timber or *non-timber forest products* (NTFPs). Timber markets, in particular, provide for little differentiation of logs or sawn wood originating from forest-based communities. Demands for Forest Stewardship Council (FSC) certification are often too costly for forest-based communities, and local communities continue to be at a market disadvantage (Macqueen *et al.*, 2006; Wiersum *et al.*, 2013).

NTFPs and agroforestry products linked to ethical trade schemes in global value chains tend to be more accessible options for gaining added value to commodities and improving revenues (Nelson *et al.*, 2002; Duchelle *et al.* 2014). In some cases, the orientation toward global markets for certified wood products has also allowed community forest enterprises (CFEs) to thrive, with important benefits for resource-poor members. In the Maya Biosphere Reserve in the Petén, Guatemala, for example, CFEs managing forest concessions rich in mahogany and other woods valued in international markets have generated employment and income that have enabled community members to move out of extreme poverty, if not poverty altogether (Stoian *et al.*, 2018).

With limited opportunities for differentiating community-based forest products in the market as such, a viable pathway out of poverty for forest-based communities is adding value to timber and NTFPs through processing and orientation toward emerging markets. Prominent examples for CFEs involved in processing logs into dried sawn wood, plywood, furniture and other value-added products include Mexico (Antinori, 2000) and Brazil (Humphries *et al.*, 2012). Certain NTFPs, in turn, may be directed toward emerging markets for 'superfoods', such as acai, camu camu, sancha inchi, aguaje and other fruits from the Amazon. Adding value to timber and NTFPs requires CFEs to have a sawmill and other diversified processing infrastructure, such as driers, furniture and mouldings factories, or chip mills (Bray and Merino-Pérez, 2002). Such infrastructure is based on investments that often imply donor or government funding, or a combination thereof.

Global markets for forest and tree crop products are entering a new phase of commitments and sustainability standards, such as 'zero net deforestation' (promoted under the UNCCD). In light of the emerging sector of impact investments which often relate to such standards, there are increasing opportunities for CFEs managing forests sustainably to attract this new type of investment to produce more semi-finished and finished products and, based on the value added, to enable their members to move out of poverty.

4.4.3 Local market dynamics

The exact proportion of forest products traded in local markets vis-à-vis those traded in global markets (see Section 4.4.2) is not readily available, nor is the exact value of trade in NTFPs which are critical for many forest-dependent communities for both income generation and household consumption (see Chapter 3). Regional market trends are available for some of the principal forest product markets in the Global North (Europe, Commonwealth of Independent States, North America), with demand for several wood-based products on the rise (UNECE/FAO, 2019), but less so for regional and local markets in the Global

South. The latter provide viable outlets for diverse forest products for individual forest users, collective businesses such as CFEs, and other types of small and medium forest enterprises (SMFEs). Compared with international markets, local markets for timber and NTFPs tend to be less demanding in terms of quality and volume requirements, certification or other sustainability standards. Barriers to enter such markets are generally lower, as are potential rewards in the form of quality or other price premiums. Even in domestic timber markets, formal and informal barriers relating to forest and tree tenure, high transaction costs due to cumbersome regulations, and bribes to speed up bureaucratic procedures, may restrict growth and obstruct opportunities for CFEs (Southgate *et al.*, 2000; Gritten *et al.*, 2015; Pulhin and Ramirez, 2016).

In view of growing populations in most of the Global South, local demand is growing for agricultural products, timber, wood-based products and NTFPs such as traditional medicines, fruits, fibres, dyes, seeds, oils, resins and gums (Kusters *et al.*, 2006). Recent studies of NTFP markets in the Brazilian Amazon, for example, have shown economic potential, along with a need for investments in infrastructure for production, training and organisation of extractive communities, and marketing support (Angelo *et al.*, 2018). Better positioning of CFEs and other SMFEs in national and international markets requires upgrading their technical, business and financial capacities to add value to timber and NTFPs, reduce production and administration costs, engage in new business relationships, and negotiate more favourable terms of trade (Donovan *et al.*, 2006). Timber and NTFP marketing may also be combined with recreational ecosystem services in pursuit of multifunctional livelihoods and enhanced social values of communities engaged in forest product extraction (Carvalho Ribeiro *et al.*, 2018). More generally speaking, there is potential for using a forest-based bioeconomy frame for NTFPs to contribute to human nutrition, renewable materials, cultural and experiential services, job creation and income opportunities in rural areas (Weiss *et al.*, 2020).

4.4.4 Infrastructure development

The development of infrastructure has profound implications for forests and tree-based systems (Laurance *et al.*, 2015). Yet, improved access to commodity and labour markets through the construction of roads, clean water and energy can lead to substantial reductions in poverty (Collier, 2007). These benefits are often driven by lower transportation costs to and from markets, the diversification of livelihoods as rural households complement agricultural incomes with other income sources, and better health outcomes through improvements in sanitation and access to health facilities. However, market integration is often associated with increases in deforestation (Geist and Lambin, 2002) driven both by the expansion of agricultural production of already resident households (Oldekop *et al.*, 2013), as well as through access to forest frontiers that facilitate in-migration for access to new lands, and illicit activities such as illegal timber extraction (Barber *et al.*, 2014). In-migration to forest frontiers has also been linked to land disputes, especially when land tenure and rights are unclear or contested (Messina *et al.*, 2005). We explore how roads can act as both moderators of policy instruments, as well as drivers of change in forests and tree-based systems in Box 4.1.

The development of other types of infrastructure, including the construction of hydroelectric dams and expansion of extractive industries such as mining, is often associated with pollution and rural livelihood losses due to conflicts over land and access to natural resources, although beneficial effects may include electrification and increases in incomes through the creation of low-skilled labour markets. Dams and mining activities are also often associated with increases in deforestation (Bebbington *et al.*, 2019), and the down-grading, down-sizing and de-gazettement of protected areas (Golden Kroner *et al.*, 2019).

The development of mega-infrastructure projects such as the Chinese-led Belt and Road Initiative, the Lamu Port and Lamu – Southern Sudan – Ethiopia Transport Corridor (LAPSSET Kenya) and India's 'Make in India' initiative, which aim to increase national and international connectivity and secure access to energy and natural resources, will be transformational for forest landscapes (Ascenção *et al.*, 2018), and likely generate both positive and negative effects for forests and rural communities.

4.5 Political and Policy Context

The political context frames the ways in which stakeholders will interact within the forest-poverty space. Many of the actions and resources required to maximise the potential of forests to contribute to economic growth and poverty alleviation are linked to the effective design and implementation of institutions. Commonly understood as "humanly devised constraints that shape human interaction or the rules of society" (North, 1990),

institutions determine the structure of formal and informal power arrangements and include social norms, customs, and informal rules that are locally devised and locally enforced, as well as more formalised laws, agreements and policies implemented by governments, non-governmental and international organisations at local, national and international scales. Effective institutions are a necessary condition for well-functioning social and economic relations, and economic development (North, 1990), and are thus an important part in the analysis of natural resource use and poverty (Box 4.2). Numerous factors operate within the political and policy context. Here we highlight tenure and property rights and decentralisation, elite capture, illegal activities and corruption, and a range of government support programmes such as subsidies, credits, social protection mechanisms and agricultural technologies.

4.5.1 Tenure and property rights and decentralisation

Contemporary policy issues in the forest sector related to tenure and property rights include: the devolution of tenure from centralised governments to communities and private entities, and the decentralisation of forest management to local governments and movements to formalise property rights throughout the developing world (Agrawal and Ostrom, 2001; Jagger *et al.*, 2014, Galik and Jagger, 2015; Sikor *et al.*, 2017; Miller *et al.*, 2019). Tenure and property rights thus act as levers of change (Chapter 5) and also provide a policy environment linked to other types of interventions and agendas (e.g. *forest restoration* initiatives) (Erbaugh *et al.*, 2020).

Indigenous peoples and local communities have legally recognised rights to an estimated 15.3% of the world's forests (RRI, 2017), although a much larger share is contested. Theoretical and empirical work has shown that where tenure and property rights are unambiguous, justly enforced and secure, rightsholders are more likely to invest in forest-enhancing behaviours because they are more likely to capture the benefits of their investments (Ostrom, 1990; Somanathan *et al.*, 2009; Mogoi *et al.*, 2012). This improved efficiency, accountability, equity and sustainability in the production and provision of forest goods and services presents opportunities for poverty alleviation (Adam and Eltayeb, 2016). Forest benefits and household income can come from the sustainable use of forest products, such as timber, construction materials and firewood. Forest revenue streams can account for as much as half of a household's income (Hill, 1999). Access and withdrawal rights to productive resources for forest-dependent people, indigenous people and women are therefore considered a crucial factor in poverty alleviation (Schlager and Ostrom, 1992).

Decentralisation is the process by which a central government cedes powers to actors and institutions at lower levels of government (Ribot 2002). Many natural resource management decentralisation reforms involve changes in ownership or changes in property rights structures (Larson and Soto, 2008; Jagger *et al.*, 2014). Although there is evidence that decentralisation and tenure reforms can lead to reductions in deforestation and poverty (Blackman *et al.*, 2017; Oldekop *et al.*, 2019; Miller *et al.*, 2019), the extent to which decentralisation programmes in developing countries should incorporate goals of poverty alleviation continues to be debated (Samii *et al.*, 2015). Tenure reforms continue to face challenges in lower- and middle-income countries, including: states retaining control of high-value forest (Barrow *et al.*, 2016) and decentralising low-value degraded forestland in need of restoration (de Royer *et al.*, 2018); persistent marginalisation of women's rights to resources (Namubiru-Mwaura, 2014; Elias *et al.*, 2017); and differential livelihood impacts on ethnic minorities, and other marginalised groups (McElwee, 2009; Jagger *et al.*, 2014).

4.5.2 Elite capture

Elite capture refers to the process of corruption through which individuals with high-level political status derived from their wealth, education, ethnicity or other social characteristics reap a disproportionately large share of benefits from resources (Bardhan, 2002; Persha and Andersson, 2014). Elite capture is thus a leading driver of *inequality* in access to resources.

In forests and tree-based systems, elite capture manifests itself through systematic forest policy biases that benefit an influential group (elites), and has often been linked to decentralisation, tenure reforms and community-driven initiatives (Platteau, 2004; Dasgupta and Beard, 2007; Lund and Saito-Jensen, 2013; Persha and Andersson, 2014). For example, despite evidence that community forestry can reduce poverty (Rahut *et al.*, 2015; Bijaya *et al.*, 2016; Oldekop *et al.*, 2019), and in some instances also reduce income inequalities (López-Feldman *et al.*, 2007), many studies have also demonstrated that community forestry can make life harder for the poor and marginalised through various forms of unequal benefit distribution. In Kenya, Chomba *et al.* (2015) and Mutune

et al. (2017) found that community forestry has led to increases in inequality by restricting forest access for the poorest community members. Similar inequities have also been observed in numerous other countries with community forestry programmes, including Ghana (Baruah, 2017), India (Mukherjee *et al.*, 2017), Indonesia (Bong *et al.*, 2019), Madagascar (Brimont *et al.*, 2015), Mexico (Garcia-Lopez, 2019) and Nepal (Bijaya *et al.*, 2016). Failure to account for heterogeneities in political power, socio-economic status, knowledge among forest resources users, and vulnerable groups in the decision-making processes allows wealthier elite members to exercise power over poor and disadvantaged households, and capture the majority share of benefits from community forestry (Adhikari *et al.*, 2014; Persha and Andersson, 2014; Sunam and McCarthy, 2016; Essougong *et al.*, 2019). Critically, elite capture can constrain the implementation of forest conservation and development policy instruments that leverage land titling and community institutions (To *et al.*, 2012; Chomba *et al.*, 2015). For example, payment for ecosystem services schemes require secure titles. In Kenya and Vietnam colonial land tenure legacies have disproportionately disadvantaged households with few or no land entitlements (To *et al.*, 2012; Chomba *et al.*, 2015). Similarly, communities with weaker internal governance structures in Ecuador were less likely to perceive benefits from payments for ecosystem services to be equitable (Hayes and Murtinho, 2018).

4.5.3 Forest crime and corruption

Forests can conceal a number of illicit activities, including cultivation of illegal drugs and illegal mineral extraction as well as harbouring insurgent groups. Illegal logging is perhaps the most widespread 'forest crime', and forms part of a broader problem of malpractice and crime associated with the timber trade (Kleinschmit *et al.*, 2016; Tacconi *et al.*, 2016). Illegal logging has significant negative environmental and social consequences. It results in biodiversity depletion, soil erosion and increased carbon dioxide emissions (Putz *et al.*, 2012; Edwards *et al.*, 2014). Economically, it deprives governments of tax revenue and increases the global supply of timber, depressing prices and placing businesses that trade in legally-sourced timber at a comparative disadvantage (Pacheco *et al.*, 2016). Socially, the problem erodes the lifestyles of traditional forest communities and often accompanies criminal activities that lead to poverty in forests, such as violence against communities that resist illegal logging, illicit drug cultivation, armed insurgency and the forced exploitation of labour (Reboredo, 2013; Pacheco *et al.*, 2016).

Globally, forest crimes were estimated to total USD 30-100 billion per year, or 10 to 30% of the global timber trade (Nellemann *et al.*, 2014). Pellegrini (2011) reported that illegal logging made up 70-80% of the total timber volumes extracted from forests in Bolivia, Honduras and Nicaragua. The countries most afflicted are the tropical regions of Latin America (Brazil, Colombia, Peru), Africa (Cameroon, Democratic Republic of the Congo, Republic of Congo), Asia and the Pacific (Indonesia, Laos, Malaysia, Myanmar, Papua New Guinea), and Russia (Humphreys *et al., 2006*; Smirnov *et al.*, 2013; Gan *et al.*, 2016). Corruption and weak governance of the forest sector remain widespread (Sündstrom, 2016). In Indonesia alone, a report from Human Rights Watch (2013) found that forest sector corruption cost the government USD 7 billion per annum between 2007 and 2011, equivalent to the country's entire spending on health care, with half of all timber logged illegally.

Well-equipped and armed illegal loggers are often the most powerful organised force in many remote forest regions, with a greater visibility and presence than the state. Forests also conceal other criminal activities such as drug cultivation, guerrilla armies, illegal mining and enslavement. For example, *habilitación* in Peru is a form of debt servitude. A lender, or *habilitador*, will lend money to an intermediary (the *patrón*) who will lend it to loggers at a high rate of interest. From the loan the logger must buy equipment and tools, hire labour, such as chain saw operators and cooks, and procure fuel and food. The logger must then hand over to the *patrón* an agreed volume and type of timber in order to pay off the debt. Often repayment of the full debt is impossible, especially when the *patrón* deliberately undervalues the timber harvested in order to perpetuate the debt. The logger must often ask for a further loan to repay the original debt, so the vicious cycle of poverty and crime continues (Urrunaga *et al*,. 2012).

4.5.4 Government support programmes for rural areas

Subsidies, credits, and social protection programmes (e.g. conditional cash transfers or public work programmes) can help reduce vulnerabilities of rural households and have important implications for poverty and livelihoods in forests and tree-based systems. While the adoption of new technologies also occurs independently from the implementation of public policies, often

Simple huts made with locally available materials are a common sight on the hills of Vietnam
Photo © Terry Sunderland

subsidies, credits, social protection programmes and agricultural technologies are intertwined. For example, rural credits and cash transfers are common components of social protection programmes (Dyngeland *et al.*, 2020), and are often invested in agricultural technologies. Similarly, public work programmes can specifically target the development of irrigation technologies to improve agricultural production and household *resilience* to environmental shocks.

Understanding these factors is critical, because the adoption of agricultural technologies (e.g. mechanisation, agricultural inputs and irrigation) can help improve agricultural production, increase income through improved yields, and reduce household reliance on forests. Critically, the uptake and use of inputs has, in turn, been catalysed by advances and adoption of mobile phone technologies. In Kenya, the M-PESA mobile phone-based money transfer service (now operating in several other African countries), has significantly eased and lowered financial transaction costs in rural areas (Mbiti and Weil, 2016) and significantly increased the use of agricultural inputs by rural households (Kirui *et al.*, 2013). Information and communication technologies more broadly, are having transformational impacts in forest communities allowing them to map and monitor forest resources (Oldekop *et al.*, under review; see Chapter 6).

Similarly, subsidies (e.g. in the form of agricultural inputs and technologies) and the availability of rural credits can provide financial incentives to support investments in agricultural production by rural households (Druilhe and Barreiro-Hurlé, 2012). However, the ability of subsidies and credits to reduce rural poverty and deforestation – at least in the absence of additional land-use conditionalities – remains disputed (Hemming *et al.*, 2018; Vang Rasmussen *et al.*, 2018). Critically, subsidies and other types of policy incentives can also generate perverse outcomes, if they are not well designed. For example, the Grain-for-Green programme in China was developed to combat soil erosion on sloping lands in the wake of the Yangtze River flood (Liu *et al.*, 2008). Despite evidence of some positive socio-economic impacts and enhanced reforestation efforts (Peng, 2007; Liu *et*

al., 2008), much of the reforestation efforts of the Grain-for-Green programme has been monoculture *plantations*, which have little ecological or biodiversity value (Hua *et al.*, 2016).

Social protection policies have improved education outcomes of forest-dependent communities in Mexico (De Janvry *et al.*, 2006), and nutrition in the Brazilian Amazon (Piperata *et al.*, 2011). In addition to formal state-led social protection programmes, forest producer organisations can provide informal social protection by offering financial support in savings and credits as seen in China, India and Uganda (Tirivayi *et al.*, 2018). However, the effects of social protection programmes on deforestation remain poorly understood (Alpízar and Ferraro, 2020). Mexico's *Oportunidades* programme was found to increase deforestation (Alix-Garcia, 2013). Brazil's *Fome Zero* programme has been shown to have both positive and negative effcts on forest cover (Dyngeland *et al.*, 2020), while recent evidence from Indonesia suggests that social protection has helped to reduce deforestation (Ferraro and Simorangkir, 2020).

4.6 Environmental Context

Environmental factors are predominantly time invariant and, in the case of climate change, effects are often of slow onset and characterised by long time lags. These factors and processes characterise boundaries, constraints, and limits to forest dynamics and livelihood activities, and are thus extremely difficult to change through interventions and policy instruments. For the purposes of this analysis, we highlight both geographical factors and climate change.

4.6.1 Geographical factors: location, topography and climatic conditions

Geographical factors – including location, topography and climatic conditions – have a strong influence on the relationship between forests and people (Sunderlin *et al.*, 2005). This link is perhaps most starkly evident in Geist and Lambin's (2002) seminal study of the drivers of tropical deforestation across 152 cases. They found striking regional differences, with only the development of market economies and the expansion of permanently cropped land for food to have geographically invariant effects on deforestation. All other factors (e.g. institutional, technological, and demographic) were found to have distinct regional patterns in the ways that they influence forest loss and, by extension, livelihoods.

Topography affects forest structure, function, dynamics – including post-disturbance recovery rates – in its regulation of temperature, precipitation and moisture, as well as energy and nutrients along elevation gradients (Hadley, 1994; Muscarella *et al.*, 2020) and thus indirectly influences the forest resources available to local people. For example, in a mountainous community in a subtropical climate zone in China studied by Song *et al.* (2018), ample heat and water resources led to high forest coverage. The vast majority of households studied relied on fuelwood as the primary source of energy despite tremendous economic growth, and a significant number of households cultivating cash crops used fresh logs inside forests as a major source of income (Zhang *et al.*, 2019). In contrast, in a semi-arid community in the Loess Plateau, China, the major source of income is from apples and walnuts (Song *et al.*, 2014).

In addition to influencing forest-poverty dynamics through integration into market economies and access to amenities, geographical location, in particular distance to urban centres and transportation hubs (e.g. seaports), has also been shown to influence political agency. Remote communities are often at a disadvantage, because political relations are often formed and maintained in urban settings (Sunderlin *et al.*, 2005). Despite broad acknowledgement that biophysical factors are key determinants of forest-poverty dynamics, our understanding of factors like location, topography and climatic conditions remains limited due to biases of where studies are conducted (Hajjar *et al.*, 2016; Cheng *et al.* 2019; Miller and Hajjar, 2020) and the variables that are included in analyses (Hajjar *et al.*, 2016).

4.6.2 Climate change and related policies

Contemporary climate change policies and actions place both forests and the communities that depend on them in the global spotlight – both in terms of the impact of climate change on forests and the role of forests in reducing or exacerbating climate change (Parrotta *et al.*, 2012; Griscom *et al.*, 2017; Watson *et al.*, 2018).

First, climate change – manifested through increasing temperatures, variations in rainfall, and more frequent and intense natural disasters – threatens both forest cover and the integrity of forests' biological functions (Trumbore *et al.*, 2015). For example, excessive precipitation (Hubbart *et al.*, 2016) and exceptional droughts (Millar and Stephenson, 2015) increase forests' susceptibility to floods, wildfires and diseases. When climatic stressors affect biological processes, this in turn

threatens ecosystem services provided by forests, like nutrient cycling, soil and water conservation, and preservation of biodiversity (Ellison *et al.*, 2017; IPBES, 2019; Piao *et al.*, 2019). Moreover, climatic stressors might cause defoliation and tree mortality leading to declining forest productivity over large spatial scales (Brienen *et al.*, 2015). Severe droughts have caused widespread *forest degradation* in Amazonia (Xu *et al.*, 2011) and the Congo Basin (Zhou *et al.*, 2014), and drought-induced large-scale tree mortality in the western United States (van Mantgem *et al.*, 2009). Forest fires are also expected to increase with subsequent consequences for forest-dependent livelihoods and human health (Barbero *et al.*, 2015; Alencar *et al.* 2015; Tan-Soo and Pattanayak, 2019). A separation of cause and effect may be observed, with the consequences of climatic change on forests and large-scale forest clearance often experienced thousands of kilometres from where the deforestation occurs (Lawrence and Vandecar, 2015). The cumulative effects of climate change on biodiversity threaten more than one million species (IPBES, 2019). Finally, negative impacts on natural resource dependent livelihood strategies might be an immediate consequence of extreme climatic events, although households may also be able to recover over the longer term (Bauer *et al.*, 2018).

Second, forests are a key mechanism for mitigating climate change through forest restoration, protection and sustainable management because forests (including peatlands) are the most important biome that removes CO_2 from the atmosphere for long-term storage (Dixon *et al.*, 1994; Pan *et al.*, 2011; Bastin *et al.*, 2019). The Bonn Challenge on *forest landscape restoration*, launched in 2011 and extended in 2014 by the New York Declaration on Forests, has a target of restoring 350 million hectares across the globe by 2030 – corresponding to 3% of the global ice-free land area. These forest-based climate change *mitigation and adaptation* efforts (i.e., wide-scale reforestation and restoration initiatives) have the potential to sequester large amounts of carbon and will provide new opportunities and challenges for forest-dependent communities – notably concerning alignment with other sustainability agendas, including poverty-alleviation, land rights and food security (Mansourian *et al.*, 2020).

4.7 Implications for Forest-Poverty Dynamics, Conclusions and Gaps

The factors that we highlight in this chapter represent a wide range of social, economic, political, and environmental contexts that shape forest-poverty dynamics. Although they influence forest-poverty dynamics at very local scales, they represent processes and forces that are often external to local forest communities (e.g. labour markets driving rural outmigration), exert influence over large geographical scales (e.g. climate change) and are subject to political and economic forces operating at subnational, national and international scales (e.g. large-scale infrastructure investments). Critically, many of these contexts and factors co-occur in time and space, and our illustrations in Box 4.1 demonstrate how different factors can simultaneously act as drivers, mediators, and moderators within causal chains. The multi-scalar nature of contexts and their complex interactions have implications for the design, implementation and evaluation of levers of change (Chapter 5). This includes the need for policy instruments that can operate across scales (e.g. international climate agreements that influence the implementation of different interventions at local scales).

However, despite substantial theoretical advances, our empirical understanding of complex social-ecological systems, and how different social, economic, political and environmental factors intersect to shape forest-poverty dynamics remains limited. Equally, there is a dearth of evidence on the effectiveness of policy instruments in the forest sector to reduce poverty. This is due to four key features of scholarly work on social-ecological systems study so far.

First, studies so far have been largely mono-deterministic (Alix-Garcia *et al.*, 2015; Schleicher *et al.*, 2017; Oldekop *et al.*, 2019). Research has predominantly focused on trying to estimate the effects of single drivers or processes of change (e.g. how do remittances affect poverty in rural households? or, what is the role of community forest institutions in reducing poverty?). While these approaches have highlighted some key drivers of change in forests and tree-based systems, they have been unable to shed light on the relative effects of different drivers of change or how they interact to jointly shape socio-environmental outcomes.

Second, studies have so far largely been mono-consequential (Agrawal and Chhatre, 2011). Research has focused on estimating single effects (e.g. how does market integration affect rural incomes?). While these studies have highlighted key relationships between drivers and outcomes, they have been unable to account for multiple effects, including positive and negative feedbacks, or unintended outcomes that might signal synergies, positive joint outcomes or substantial trade-offs (Dyngeland *et al.*, 2020).

Third, studies have largely been unable to account for local socio-economic contexts. This is due to: i) a lack of comparative case studies (either within or between countries) that explicitly focus on elucidating the role of local socio-economic, political, and biophysical contexts in shaping both forest-poverty dynamics and how forest-based interventions and policy instruments are implemented (Angelsen *et al.*, 2014); ii) insufficient integration of socio-economic, political, and cultural variables into quantitative analyses (Hajjar *et al.*, 2016); and iii) insufficient use of analytical tools to assess how local contexts shape the outcomes of forest-based interventions and policy instruments. Finally, most socio-economic and policy contexts are fluid and dynamic. Despite this, most studies of forest-poverty dynamics have been conducted at single points in time (e.g. Persha *et al.*, 2011), thus failing to capture important shifts in the relationship between forests and poverty that play out over long time horizons. While the number of studies assessing changes over two time-points has increased in the past decade (e.g. Andam *et al.*, 2011; Alix-Garcia *et al.*, 2018; Oldekop *et al.*, 2019), there is a critical dearth of studies tracking forest-poverty dynamics over multiple time points (Jung *et al.*, 2019; see also Chapter 2).

These gaps in our knowledge hamper our ability to understand important relationships among the numerous components of social-ecological processes, and how these change over time, and the importance of social and environmental feedback loops. Many studies conclude that forest-poverty dynamics are the outcome of irreducible complexity because they have neglected to examine long-term change. We therefore recommend that future research should focus explicitly on comparisons over time, and not simply comparisons between different forest spaces. Failing to capture the temporal dimension of forest-poverty dynamics in future studies will continue to hamper our ability to identify the levers for positive change that maximise joint and lasting outcomes for forests and people.

Advances in analytical tools, and the increasing availability of social and environmental data from multiple sources (see Chapter 6) provide a potential way of bridging existing knowledge gaps. To better understand the role of socio-economic, political, and biophysical contexts, future research should place greater emphasis on longitudinal approaches, causal chains and comparative analyses. In addition to leveraging novel data sources, gaining a deeper understanding also requires closer alignment between qualitative and quantitative approaches.

Protected areas attract tourism, becoming a source of income for local communities. Photo of a landscape in the Tian Shan Mountains, Kyrgyzstan
Photo © Nelson Grima

Box **4.1**

Empirical examples of drivers, mediators and moderators

We illustrate how factors discussed in the social, economic, policy, and biophysical contexts relate to each other and can take on multiple roles as drivers, mediators, and moderators of social and environmental change in forests and tree-based systems using two examples. Our examples are centred on the effects of two policy levers discussed in Chapter 5, protected areas and community forestry, and how they intersect with multiple factors.

Protected areas

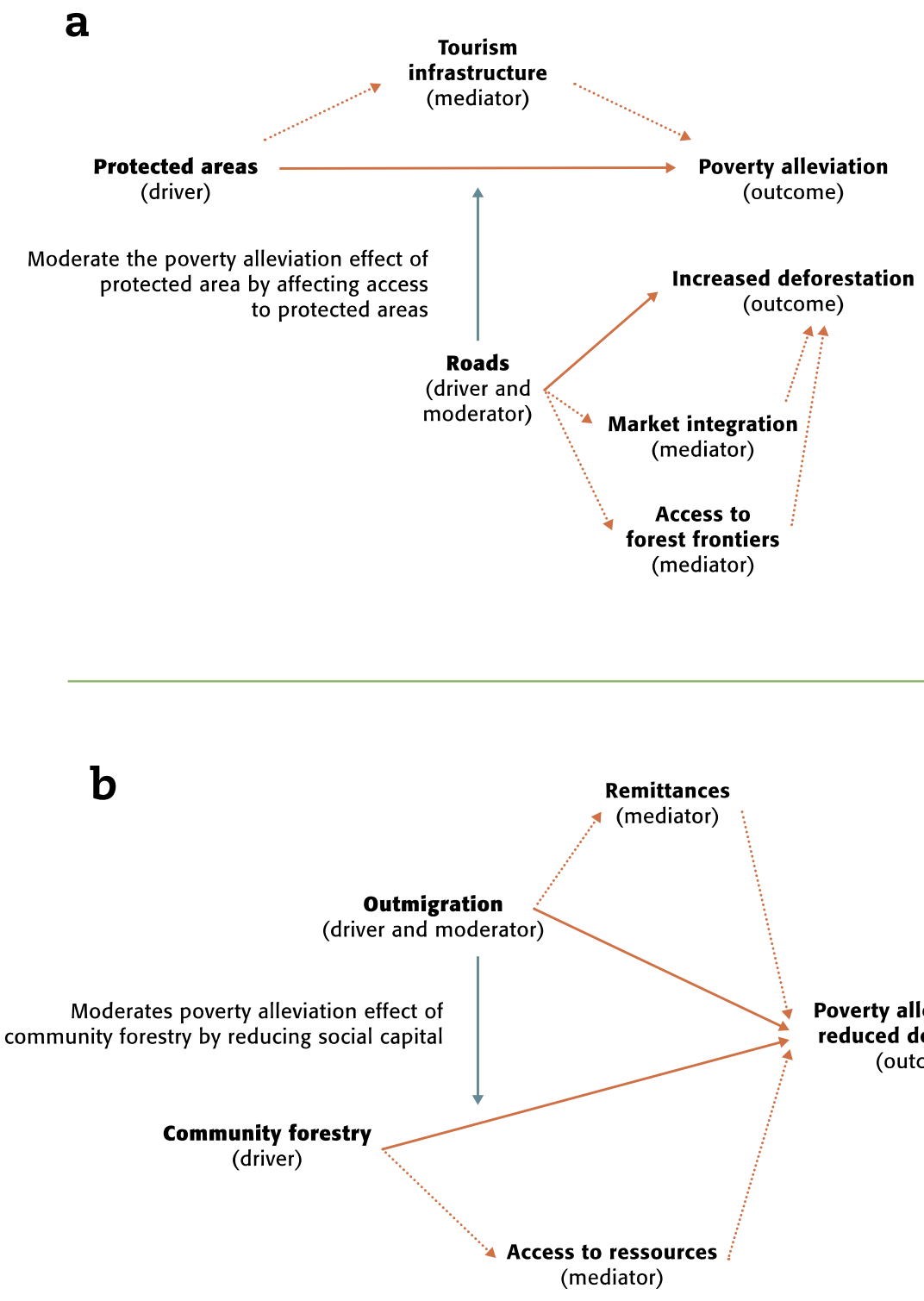
Protected areas are a cornerstone of forest conservation (Watson *et al.*, 2014). Several large-scale data-driven studies that specifically sought to control for numerous socio-economic factors, have demonstrated that protected areas can be key drivers of poverty reduction and improved well-being (Andam *et al.*, 2010; den Braber *et al.*, 2018; Naidoo *et al.*, 2018, Figure 4.2a). One of the mechanisms or mediators through which protected areas reduce poverty is tourism-related infrastructure (Ferraro and Hanauer, 2014; den Braber *et al.*, 2018), which generates opportunities for income generation. The poverty alleviation effect of protected areas is influenced or moderated by roads, which facilitate access to protected areas (Ferraro *et al.*, 2011): the poverty alleviation effect of protected areas that are more remote and more difficult to access is lower than the poverty alleviation effect of protected areas that are more accessible. In addition to being a moderator of protected area effects, roads can also act as a driver of deforestation (Geist and Lambin, 2002; Laurance *et al.*, 2015). This effect is mediated by various factors, including market integration which stimulates agricultural production and expansion (Oldekop *et al.*, 2014), and facilitated access to forest frontiers (Laurance *et al.*, 2015). In this example of protected areas, roads act both as moderators and drivers of social and environmental change.

Community forestry

Both community forestry and rural outmigration have been shown to act as drivers of poverty alleviation and reductions in deforestation (e.g. Oldekop *et al.*, 2018; Oldekop *et al.*, 2019; Figure 4.2b). One of the mechanisms or mediators through which outmigration affects poverty alleviation in rural households and reductions in deforestation is through remittances, which provide direct cash revenue for rural households and reduce dependence on agricultural production and forests. In the case of community forestry, one of the mediators through which poverty alleviation and reductions in deforestation are affected is through greater access to forest resources, such as timber and non-timber forest products (e.g. composting materials) that can be sold or used as inputs for agricultural production, and thus providing an incentive for long-term management. However, both drivers co-occur in time and space, and thus have the potential to interact to jointly shape poverty alleviation and deforestation outcomes. Evidence from Mexico suggests that rural outmigration also acts as mediator of community forestry. Outmigration has weakened community social capital and negatively influenced community forestry management institutions (Robson and Berkes 2011a), with potential negative environmental effects (Robson and Berkes, 2011b). Our understanding of the interactions between outmigration and community forests, or indeed how other drivers of change interact to affect social and environmental outcomes in forest landscapes, and how these interactions are influenced by broader socio-economic and biophysical contexts remains a key research frontier. A better understanding of these relationships has implications for the design of forest-based interventions that are more attuned to local, social, and environmental dynamics.

Figure **4.3**

Relationship between drivers, mediators and moderators of protected areas (a), and community forestry effects (b) on poverty and forest outcomes



Box **4.2**

Forest management institutions: Examples from Africa

Analyses of the forestry sector in diverse countries in Africa show that the sector has changed considerably in recent times. New actors have emerged to fulfil unique roles in forestry. The private sector, local communities and NGOs are increasingly taking up forest management roles (FAO, 2003; Cheboiwo *et al.*, 2018) thus expanding the democratic space for public and private sector interests. While NGOs and the private sector play a role in ensuring that forestry activities improve economic outcomes for forest dependent people, governments' facilitating role has become crucial to ensuring that policies create conditions to promote economic growth, increase incomes and minimise inequalities.

Most African countries have official forest agencies whose mandates mostly relate to protection and management of government forests, law enforcement, and advisory services. In the past few decades, reforms have focused on decentralisation and the devolution of powers, and placed increased emphasis on community participation and benefits. In Mali, Mozambique, and Uganda, national *poverty eradication* strategies have included public investment plans that empower local communities (Greely and Jenkins, 2000), although tangible benefits for many forests and rural communities are yet to materialise (e.g. Banana *et al.*, 2014). In contrast, decentralisation efforts in most other African countries have not been accompanied by such efforts to build human, financial and technical capacities (Lundgren, 2015). Serious staff shortages at field operation levels (Lundgren, 2015) have severely constrained support to communities' forestry activities, and local organisations created to improve incomes feature weakly in national plans and budgets. The relationship with governments remains weak and community activities are considered only informally.

Close collaboration between the state and non-state actors championing the interests of the poor, weak and marginalised remains an important enabling factor for realising poverty reduction in many parts of Africa. Comprising "a sphere of public life beyond the control of the state" (Colas, 2002), NGOs have an economic role to play in providing the collective goods that would otherwise be undersupplied by the private market. Their increasing role in influencing forest resources management and governance through advocacy for, and support of, community participation is prominent. Their capacity building efforts on livelihoods development facilitate the participation of poor communities in economic activities. Many NGOs have supported communities in establishing community forestry associations as locally based platforms to engage in agroforestry as a pathway out of poverty. Ghana, Somalia, and Uganda have reported positive contributions by NGOs towards improved representation of poor and marginalised communities in governance processes (Adjei *et al.*, 2012; Dahie, 2019).

Private sector participation in forestry in Africa has increased substantially over the past few decades with substantial investments in concessions for timber and agricultural production (Brandt *et al.*, 2016). Although large-scale land acquisitions (often termed 'land grabs') have become integral to national development strategies in Africa (and beyond), there is evidence that concessions – including those under sustainable management – are active contributors to deforestation (Brandt *et al.*, 2016). Further, evidence on the livelihood impacts of concessions is mixed. Land acquisitions have been linked to losses in agricultural lands and livelihood displacements that particularly disadvantage women (Hajjar *et al.*, 2020). However, other studies suggest that land acquisitions can contribute to indirect, non-subsistence job creation through increased demand for goods and services (Jung *et al.*, 2019).

4.8 References

Adam, J., 2010. Post-Conflict Ambon: Forced Migration and the Ethno-Territorial Effects of Customary Tenure. *Development and Change* 41 (3): 401-19.

Adam, Y. O. and Eltayeb, A. M., 2016. Forestry decentralization and poverty alleviation: A review. *Forest Policy and Economics* 73: 300-307.

Adhikari, S., Kingi, T. and Ganesh, S., 2014. Incentives for community participation in the governance and management of common property resources: the case of community forest management in Nepal. *Forest Policy and Economics* 44:1-9.

Adjei, P. O. W., Agyemang, S. and Afriyie, K. 2012. Non-Governmental Organizations and Rural Poverty Reduction in Northern Ghana: Perspectives of Beneficiaries on Strategies, Impact and Challenges. *Journal of Poverty Alleviation and International Development* 3 (2): 47-73.

Andam, K. S., Ferraro, P. J., Sims, K. R. E., Healy, A. and Holland, M., 2010. Protected areas reduced poverty in Costa Rica and Thailand. *PNAS* 107 (22): 9996-10001.

African Development Bank, 2019. *Towards Large-Scale Commercial Investment in African Forestry. A Study for the Climate Investment Funds Evaluation & Learning Initiative*. Abidjan: African Development Bank.

Agarwal, B., 2001. Participatory Exclusions, Community Forestry, and Gender: An Analysis for South Asia and a Conceptual Framework. *World Development* 29 (10): 1623-1648.

Agarwal, B., 2009. Gender and forest conservation: The impact of women's participation in community forest governance. *Ecological Economics* 68(11): 2785-2799.

Agrawal, A. and Gibson, C.C. 1999. Enchantment and Disenchantment: The Role of Community in Natural Resource Conservation. *World Development* 27 (4):629-649.

Agrawal, A., Chhatre, A. and Hardin, R., 2008. Changing governance of the world's forests. *Science* 320 (5882): 1460-1462.

Agrawal, A. and Chhatre, A., 2011. Against mono-consequentialism: Multiple outcomes and their drivers in social-ecological systems. *Global Environmental Change* 21 (3): 1-3.

Agrawal, A., Brown, D. G. and Sullivan, J. A., 2019. Are global land grabs ticking socio-environmental bombs or just inefficient investments. *One Earth* 1 (2): 159-162.

Alencar, A. A., Brando, P. M., Asner, G. P. and Putz, F. E., 2015. Landscape fragmentation, severe drought, and the new Amazon forest fire regime. *Ecological Applications* 25 (6): 1493-1505.

Agrawal, A. and Ostrom, E., 2001. Collective action, property rights, and decentralization in resource management in India and Nepal. *Politics and Society* 29 (1): 485-514.

Alix-García, J. M., McIntosh, C. and Sims, K. R. E., 2013. The ecological footprint of poverty alleviation: evidence from Mexico's Oportunidades program. *Review of Economic Statistics* 95: 417-435.

Alix-García, J. M., Sims, K. R. E. and Yañez-Pagans, P., 2015. Only One Tree from Each Seed? Environmental Effectiveness and Poverty Alleviation in Mexico's Payments for Ecosystem Services Program. *American Economic Journal: Economic Policy* 7 (4): 1-40.

Alix-García, J. M., Simes, K. R. E., Orozco-Olvera, V. H., Costica, L. E., Fernández Medina, J. D. and Romo Monroy, S., 2018. Payment for environmental services supported social capital while increasing land management. *PNAS* 115 (27): 7016-7021.

Alpízar, F. and Ferraro, P. J., 2020. The environmental effects of poverty programs and the poverty effects of environmental programs: The missing RCTs. *World Development* 127: 104783.

Angelo, H., de A Calderon, R., de Almeida, A.N., de Paula, M.F., Meira, M., Miguel, E.P. and Vasconcelos, P.G., 2018. Analysis of the non-timber forest products market in the Brazilian Amazon. *Australian Journal of Crop Science* 12 (10): 1640.

Angelsen, A., Jagger, P., Babigumira, R., Belcher, B., Hogarth, N.J., Bauch, N., Börner, J., Smith-Hall, C. and Wunder, S., 2014. Environmental Income and Rural Livelihoods: A Global-Compartive Analysis. *World Development* 64: S12-S28.

Anthias, P. and Radcliffe, S. A., 2015. The Ethno-Environmental Fix and Its Limits: Indigenous Land Titling and the Production of Not-Quite-Neoliberal Natures in Bolivia. *Geoforum* 64: 257-69.

Antinori, C. M., 2000. *Vertical Integration in Mexican Common Property Forests.* PhD dissertation, University of California.

Ascencão, F., Fahrig, L., Clevenger, A. P., Corlett, R. T., Jaeger, J. A. G., Laurance, W. F. and Pereira, H. M., 2018. Environmental challenges for the Belt and Road Initative. *Nature Sustainability* 1: 206-209.

Badola, R. and Hussain, S. A., 2003. Conflict in paradise - Women and protected areas in the Indian Himalayas. *Mountain Research and Development* 23 (3): 234-237.

Banana, A. Y., Namwaala J. J., Byakagaba, P, Waiswa, D., Buyinza, M. and Gombya-Ssembajwe, W., 2014. The impacts of decentralisation reforms on sustainable forest management in Central Uganda. In: *Forests under pressure – Local responses to local issues,* edited by P. Katila, G. Galloway, W. de Jong, P. Pacheco and G. May. IUFRO World Series Volume 32.

Barber, C. P., Cochrane, M. A., Souza Jr., C. M., Laurance, W. M. 2014. Roads, deforestation, and the mitigating effect of protected areas in the Amazon. *Biological Conservation* 177: 203-209.

Bardhan, P., 2002. Decentralization of governance and development. *Journal of economic perspectives* 16 (4): 185-205.

Barrow, E., Kamugisha-Ruhombe, J., Nhantumbo, I., Oyono, R. and Savadogo, M., 2016. Who owns Africa's forests? Exploring the impacts of forest tenure reform on forest ecosystems and livelihoods. *Forests, Trees and Livelihoods* 25 (2): 132-156.

Baruah, M., 2017. Facipulation and elite formation: community resource management in Southwestern Ghana. *Conservation and Society* 15 (4): 371-383.

Bastin, J. F., Finegold, Y., Garcia, C., Mollicone, D., Rezende, M., Routh, D., Zohner, C. M., *et al.*, 2019. The global tree restoration potential. *Science* 365 (6448): 76-79.

Bauer, T., Ingram, V., De Jong, W. and Arts, B., 2018. The socio-economic impact of extreme precipitation and flooding on forest livelihoods: evidence from the Bolivian Amazon. *International Forestry Review* 20 (3): 314-330.

Barbero, R., Abatzoglou, J. T., Larkin, N. K., Kolden, C. A. and Stocks, B., 2015. Climate change presents increased potential for very large fires in the contiguous United States. *International Journal of Wildland Fire* 24 (7): 892-899.

Bebbington A, J., Humphreys Bebbington, D., Sauls, L. A., Rogan, J., Agrawal, S., Gamboa, C., Imhof, A., *et al.*, 2018. Resource extraction and infrastructure threaten forest cover and community rights. *PNAS* 115 (52): 13164-13173.

Beevers, M. D., 2015. Peace Resources? Governing Liberia's Forests in the Aftermath of Conflict. *International Peacekeeping* 22 (1): 26-42.

Belcher, B. M., 2005. Forest product markets, forests and poverty reduction. *International Forestry Review* 7 (2): 82-89.

Bijaya, G.D., Cheng, S., Xu, Z., Bhandari, J., Wang, L. and Liu, X., 2016. Community forestry and livelihood in Nepal: A review. *The Journal of Animal and Plant Sciences* 26 (1): 1-12.

Blackman, A., Corral, L., Santos Lima, E. and Asner, G., 2017. Titling indigenous communities protects forests in the Peruvian Amazon. *PNAS* 114 (16): 4123-4128.

Bob, U. and Bronkhorst, S., 2010. Environmental conflicts: Key issues and management implications. *African Journal on Conflict Resolution* 10 (2): 9-30.

Bong, I., W., Moeliono, M., Wong, G. Y. and Brockhaus, M., 2019. What is success? Gaps and trade-offs in assessing the performance of traditional social forestry systems in Indonesia. *Forest and Society* 3 (1): 1-21.

Brainard, L. and Chollet, D., 2007. *Too poor for peace? Global poverty, conflict, and security in the 21st century*. Washington D.C.: The Brookings Institution.

Brandt, J. Nolte, C. and Agrawal, A., 2016. Deforestation and timber production in Congo after implantation of sustainable forest management policy. *Land Use Policy* 52: 15-22.

Bray, D. B. and Merino-Pérez, L., 2002. *The rise of community forestry in Mexico: History, concepts, and lessons learned from twenty-five years of community forestry timber production.* Mexico City: The Ford Foundation.

Brienen, R. J. W., Phillips, O. L., Feldpausch, T. R., Gloor, E., Baker, T. R., Lloyd, J., Lopez-Gonzalez, G., *et al.*, 2015. Long-term decline of the Amazon carbon sink. *Nature* 519: 334-348.

Brimont, L., Ezzine-de-Blas, D., Karsenty, A. and Toulon, A., 2015. Achieving conservation and equity amidst extreme poverty and climate risk: the Makira REDD+ project in Madagascar. *Forests* 6 (3): 748-768.

Buvinic, M., Das Gupta, M. and Shemyakina, O. N., 2013. Armed conflict, gender, and schooling. *The World Bank Economic Review* 28 (2): 311-319.

Beevers, M. D., 2015. Peace Resources? Governing Liberia's Forests in the Aftermath of Conflict. *International Peacekeeping* 22 (1): 26-42.

Carvalho Ribeiro, S.M., Soares Filho, B., Costa, W.L., Bachi, L., de Oliveira, A.R., Bilotta, P., Saadi, A., *et al.*, 2018. Can multifunctional livelihoods including recreational ecosystem services (RES) and non timber forest products (NTFP) maintain biodiverse forests in the Brazilian Amazon? *Ecosystem Services* 31: 517-526.

Cheboiwo, J.K., Nasroun, T.H., Mwamakimbullah, R., Kyeyune, R.K. and Mutaganda, A., 2018. Public Private Partnership (PPP) in forest sector in Eastern Africa. Synthesis of primary and secondary production actors and trade. *Journal of Economics and Sustainable Developmen*t 9: 43-58.

Cheng, S.H., Ahlroth, S., Onder, S., Shyamsundar, P., Garside, R., Kristjanson, P., *et al.*, 2017. What is the evidence for the contribution of forests to poverty alleviation? A systematic map protocol. *Environmental Evidence* 6: 10.

Cheng, S.H., MacLeod, K., Ahlroth, S., Onder, S., Perge, E., Shyamsundar, P., Garside, R., *et al.*, 2019. A systematic map of evidence on the contribution of forests to poverty alleviation. *Environmental Evidence* 8: 3.

Chomba, S. W., Nathan, I., Minang, P. A. and Sinclair, F., 2015. Illusions of empowerment? Questioning policy and practice of community forestry in Kenya. *Ecology and Society* 20 (3): 2.

Chomitz, K. M., Piet, B., Giacomo, D. L., Timothy, S. T. and Sheila, W. K., 2007. *At Loggerheads? Agricultural expansion, poverty reduction and environment in the tropical forests*. Washington D.C.: The World Bank.

Clapp, J. and Dauvergne, P., 2011, *Paths to a Green World: The Political Economy of the Global Environment* (2nd edition), Cambridge, MA: MIT Press.

Collier, P., 2007. *The bottom billion*. Oxford: Oxford University Press.

Colas, A., 2002. *International Civil Society*. Cambridge: Polity Press.

Dahie A. M., 2019. Role of nongovernmental organizations on poverty reduction: empirical study from local NGOs in Mogadishu-Somalia. *European Journal of Research in Social Sciences* 7 (1): 43-55.

Dasgupta, A. and Beard, V. A., 2007. Community driven development, collective action and elite capture in Indonesia. *Development and Change* 35 (2): 229-249.

Davis, K. F., Koo, H. I., Dell'Angelo, J., D'Odorico, P., Estes, L, Kehoe, L. J., Karratzadeh, M., *et al.*, 2020. Tropical forest loss enhanced by large-scale land acquisitions. *Nature Geoscience* 13: 482-488.

Davis, B., Carletto, G. and Winters, P. C., 2010. Migration, transfers, and economic decision making among agricultural households: an introduction. *The Journal of Development Studies* 46 (1): 1-13.

Davis, J. and López-Carr, D., 2014. Migration, remittances and smallholder decision-making: implications for land use and livelihood change in Central America. *Land Use Policy* 36: 319-329.

Deda, P. and Rubian, R., 2004. Women and biodiversity: The long journey from users to policy-makers. *Natural Resources Forum* 28 (3): 201-204.

DeFries, R. S., Rudel, T., Uriarte, M. and Hansen, M., 2010. Deforestation driven by urban population growth and agricultural trade in the twenty-first century. *Nature Geoscience* 3: 178-181.

den Braber, B., Evans K. L. and Oldekop, J. A., 2018. Impact of protected areas on poverty, extreme poverty, and inequality in Nepal. *Conservation Letters* 11: e12576.

de Haas, H., 2010. Migration and Development: A theoretical perspective. *International Migration Review* 44 (1): 227-264.

De Janvry, A., Finan, F., Sadoulet, E. and Vakis, R., 2006. Can conditional cash transfer programmes serve as safety nets in keeping children at school and from working when exposed to shocks? *Journal of Development Economics* 79 (2): 349–373.

de Royer, S., Van Noordwijk, M. and Roshetko, J. M., 2018. Does community-based forest management in Indonesia devolve social justice or social costs? *International Forestry Review* 20 (2): 167-180.

Dixon, R. K., Solomon, A. M., Brown, S., Houghton, R. A., Trexier, M.C. and Wisniewski, J., 1994. Carbon pools and flux of global forest ecosystems. *Science* 263 (5144): 185-190.

Do, Q. T. and Iyer, L., 2010. Geography, poverty and conflict in Nepal. *Journal of Peace Research* 47 (6): 735-748.

Donovan, J., Stoian, D., Grouwels, S., Macqueen, D., van Leeuwen, A., Boetekees, G. and Nicholson, K., 2006. *Towards an enabling environment for small and medium forest enterprise development*. CATIE/FAO/IIED/SNV/ICCO Policy Brief. Rome: FAO.

Duchelle, A.E., Kainer, K.A. and Wadt, L. H., 2014. Is certification associated with better forest management and socioeconomic benefits? A comparative analysis of three certification schemes applied to Brazil nuts in Western Amazonia. *Society & Natural Resources* 27 (2): 121-139.

Druilhe, Z. and Barreiro-Hurlé, J., 2012. *Fertilizer subsidies in sub-Saharan Africa*. ESA Working paper No. 12-04. Rome: FAO.

Drutschinin, A. and Ockenden, S., 2015. *Financing for development in support of biodiversity and ecosystem services*. OECD Development Co-operation Working Papers, No. 23, Paris: OECD Publishing.

Dyngeland, C., Oldekop, J. A. and Evans, K. L., 2020. Assessing multidimensional sustainability: Lesson's from Brazil's social protection programs. *PNAS* (in press).

Edwards, D. P., Sloan, S., Weng, L., Sayer, J., Dirks, P. and Laurance, W.F., 2014. Mining and the African environment. *Conservation Letters* 7: 302-311.

Elias, M., Jalonen, R., Fernandez, M. and Grosse, A., 2017. Gender-responsive participatory research for social learning and sustainable forest management. *Forests, Trees and Livelihoods* 26(1): 1-12.

Ellison, D., Morris, C.E., Locatelli, B., Sheil, D., Cohen, J., Murdiyarso, D., Gutierrez, V., *et al.*, 2017. Trees, forests and water: Cool insights for a hot world. *Global Environmental Change* 43:51-61.

Erbaugh, J. T., Pradhan, N., Adams, J., Oldekop, J. A., Agrawal, A., Brockington, D., Pritchard, R. and Chhatre, A., 2020. Global forest restoration and the importance of prioritizing local communities. *Nature Ecology and Evolution* (in press).

Essougong, U. P. K., Foundjem-Tita, D. and Minang, P. A., 2019. Addressing equity in community forestry lessons from 20 years of implementation in Cameroon. *Ecology and Society* 24 (1): 9.

FAO, 2003. *Forestry Outlook study for Africa. Regional report - opportunities and challenges towards 2020*. FAO Forestry Paper 141. Rome: African Development Bank, European Commission, FAO.

FAO, 2010. *Gender Dimensions of Agricultural and Rural Employment: Differentiated Pathways out of Poverty. Status, Trends and Gaps*. Rome: FAO.

FAO, 2019. *Global forest products facts and figures 2018*. Rome: FAO.

Ferraro, P. J., Hanauer, M. M. and Sims, K. R. E., 2011. Conditions associated with protected area success in conservation and poverty reduction. *PNAS* 108 (34): 13913-13918.

Ferraro, P. J. and Hanauer, M. M., 2014a. Advances in measuring the environmental and social outcomes of environmental programs. *Annual Reviews of Environment and Resources* 39: 495-517.

Ferraro, P. J. and Hanauer, M. M., 2014b. Quantifying causal mechanisms to determine how protected areas affect poverty through changes in ecosystem services and infrastructure. *PNAS* 111 (11): 4332-4337.

Ferraro, P. J. and Simorangkir, R., 2020. Conditional cash transfers to alleviate poverty also reduced deforestation in Indonesia. *Science Advances* 6 (24): eaaz1298

Folke, C., Österblom, H., Jouffray, J.B., Lambin, E.F., Adger, W.N., Scheffer, M., Crona, B.I., *et al.*, 2019. Transnational corporations and the challenge of biosphere stewardship. *Nature Ecology & Evolution* 3 (10): 1396-1403.

Fox, J., 2018. Community forestry, labor migration and agrarian change in a Nepali village: 1980-2010. *The Journal of Peasant Studies* 45(3): 610-629.

Gadgil. M. and Guha, R., 1992. *This Fissured Land: An Ecological History of India*. Berkeley: University of California Press.

Galaz, V., Crona, B., Dauriach, A., Jouffray, J. B., Österblom, H. and Fichtner, J., 2018. Tax havens and global environmental degradation. *Nature Ecology and Evolution* 2: 1352-1357.

Galik, C.S. and Jagger, P., 2015. Bundles, duties, and rights: A revised framework for analysis of natural resource property rights regimes. *Land Economics* 91(1): 76-90.

Gan, J., Cerutti, P. O., Masiero, M., Pettenella, D., Andrighetto, N. and Dawson, T., 2016. Quantifying illegal logging and related timber trade. In: *Illegal Logging and Related Timber Trade: Dimensions, Drivers, Impacts and Responses: a Global Scientific Rapid Response Assessment Report*, edited by D. Kleinschmit, S. Mansourian, C. Wildburger and A. Purret. Vienna: International Union of Forest Research Organizations (IUFRO).

Garcia-Barrios, L., Galvan-Yiyoshi, Y. M., Valdivieso-Perez, I. A., Masera, O. R., Bacco, G. and Vandermeer, J. 2009. Neotropical forest conservation, agricultural intensification, and rural out-migration: The Mexico experience. *BioScience* 59(10): 863-873.

Garcia-Lopez, G. A., 2019. Rethinking elite persistence in neoliberalism: Foresters and techno-bureaucratic logics in Mexico's community forestry. *World Development* 120: 169-181.

Geist, H. D. and E. F. Lambin. 2002. Proximate causes and underlying driving forces of tropical deforestation. *BioScience* 52(2): 143-150.

Godar, J., Gardner, T. A., Tizado, E. J. and Pacheco, P., 2014. Actor-specific contributions to the deforestation slowdown in the Brazilian Amazon. *PNAS* 111 (43): 15591-15596.

Golden Kroner, R. E., Qin, S., Cook, C. N., Krithivasan, R., Pack, S. M., Bonilla, O. D. and Cort-Kansinally, K. A., 2019. The uncertain future of protected lands and waters. *Science* 364 (6443): 881-886.

Giri, K. and Darnhofer, I., 2010. Outmigrating men: A window of opportunity for women's participation in community forestry? *Scandinavian Journal of Forest Research* 25 (9): 55-61.

Global Financial Integrity, 2019. Illicit Financial Flows to and from 148 Developing Countries: 2006-2015. Washington DC: Global Financial Integrity (available at: https://gfintegrity.org/report/2019-iff-update/ [accessed on: 26 November 2019]).

Greely, M. and Jenkins, R., 2000. *Mainstreaming the poverty-reduction agenda. An analysis of institutional mechanisms to support pro-poor policy making and implementation in six African countries.* Brighton: Institute of Development Studies, University of Sussex.

Green, J. M. H., Croft, S. A., Durán, P. D., Balmford, A. P., Burgess, N. D., Fick, S., Gardner, T. A., *et al.*, 2019. Linking global drivers of agricultural trade to on-the-ground impacts on biodiversity. *PNAS* 116 (46): 23202-23208.

Griscom, B. W., Adams, J., Ellis, P. W., Houghton, R. A., Lomax, G., Miteva, D. A., Schlesinger, W. H., *et al.*, 2017. Natural climate solutions. *PNAS* 114 (44): 11645-11650.

Gritten, D., Greijmans, M., Lewis, S.R., Sokchea, T., Atkinson, J., Quang, T.N., Poudyal, B., *et al.*, 2015. An uneven playing field: regulatory barriers to communities making a living from the timber from their forests–examples from Cambodia, Nepal and Vietnam. *Forests* 6 (10): 3433-3451.

Hadley, K. S., 1994. The role of disturbance, topography, and forest structure in the development of a montane forest landscape. *Bulletin of the Torrey Botanical Club* 121 (1):47-61.

Hajjar R., Ayana, A. N., Rutt, R., Hinde, O. Liao, C., Keene, S., Bandiaky-Badji, S. and Agrawal, A., 2020. Capital, labor, and gender: the consequences of large-scale land transactions on household labor allocation. *Journal of Peasant Studies* 47 (3): 566-588.

Hajjar, R., Oldekop, J. A., Cronkleton, P., Etue, E., Newton, P., Russel, A. J. M., Tjajadi, J. S., *et al.*, 2016. The data not collected on community forests. *Conservation Biology* 30 (6): 1357-1362.

Harwell, E. 2011. *Forests in fragile and conflict-affected states*. Washington D.C.: World Bank.

Hayes, T. and Murtinho, F., 2018. Communal governance, equity and payment for ecosystem services. *Land Use Policy* 79: 123-136.

Hecht, S., Yang, A. L., Basnett, B. S., Padoch, C. and Peluso, N. L., 2015. *People in motion, forests in transition: Trends in migration, urbanization, and remittances, and their effect on tropical forests*. Occasional Paper 142. Bogor: CIFOR

Hemming, D. J., Chirwa, E. W., Dorward, A., Ruffhead, H. J., Hill, R., Osborn, J., Langer, L., *et al.*, 2018. Agricultural input subsidies for improving productivity, farm income, consumer welfare and wider growth in low- and lower-middle-income countries: a systematic review. *Campbell Systematic Reviews* 14 (1):1-153.

Hill, I., 1999. *Forest Management in Nepal*. Washington D.C.: World Bank.

Hubbart, J. A., Guyette, R. and Muzika, R. M., 2016. More than Drought: Precipitation Variance, Excessive Wetness, Pathogens and the Future of the Western Edge of the Eastern Deciduous Forest. *Science of the Total Environment* 566: 463-467.

Human Rights Watch, 2013. *The dark side of green growth: Human rights impacts of weak governance in Indonesia's forestry sector* (Available at: https://www.hrw.org/report/2013/07/15/dark-side-green-growth/human-rights-impacts-weak-governance-indonesias-forestry#3900 [accessed on 28.10.2020]).

Humphreys, D., 2006. *Logjam: Deforestation and the Crisis of Global Governance*. London: Earthscan.

Humphries, S., Holmes, T. P., Kainer, K., Koury, C. G. G., Cruz, E. and de Miranda Rocha, R., 2012. Are community-based forest enterprises in the tropics financially viable? Case studies from the Brazilian Amazon. *Ecological Economics* 77: 62-73.

Hunter, L. M., Luna, J. K. and Norton, R. M., 2015. Environmental dimensions of migration. *Annual Reviews of Sociology* 41: 377-397.

Henders, S., Persson, U. M. and Kastner, T., 2015. Trading forests: land-use change and carbon emissions embodied in production and exports of forest-risk commodities. *Environmental Research Letters* 10: 125012.

Hua, F., Wang, X., Zheng, X., Fischer, B., Wang, L., Zhu, J., Tang, Y., *et al.*, 2016. Opportunities for biodiversity gains under the world's largest reforestation programme. *Nature Communications* 7: 12717.

IPBES, 2013. *Decision IPBES-2/4: Conceptual Framework for the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services* (Available at: https://www.ipbes.net/system/tdf/downloads/Decision%20IPBES_2_4.pdf?file=1&type=node&id=14649 [accessed on 12 December 2020]).

IPBES, 2019. *Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*. S. Díaz, J. Settele, E. S. Brondizio E.S., H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis and C. N. Zayas (eds.). Bonn: IPBES secretariat.

Jagger, P., Luckert, M. M. K., Duchelle, A. E., Lund, J. F. and Sunderlin, W. D., 2014. Tenure and forest income: Observations from a global study on forests and poverty. *World Development* 64: S43-S55.

Jacobson, P., 2018. *Revealed: Paper giant's ex-staff say it used their names for secret company in Borneo. Mongabay.* (Available at: https://news.mongabay.com/2018/07/revealed-paper-giants-ex-staff-say-it-used-their-names-for-secret-company-in-borneo/ [accessed on 28 August 2020]).

Jung, S., Liao, C., Agrawal, A. and Brown, D.G., 2019. Evidence on Wealth-Improving Effects of Forest Concessions in Liberia. *Journal of Association of Environmental and Resource Economists* 6 (5): 961-1000.

Kaimowitz, D., 2006. Forests and armed conflict. *ETFRN News* 43/44.

Kiptot, E., Franzel, S. and Degrande, A., 2014. Gender, agroforestry and food security in Africa. *Current Opinion in Environmental Sustainability* 6: 104-109.

Kirui, O. K., Okello, J. J., Nyikal, R. A. and Njiraina, G. W., 2013. Impact of mobile phone-based money transfer services in agriculture: Evidence from Kenya. *Quarterly Journal of International Agriculture* 52: 141-162.

Kleinschmit, D., Mansourian, S., Wildburger, C. and Purret, A., 2016. *Illegal Logging and Related Timber Trade: Dimensions, Drivers, Impacts and Responses: a Global Scientific Rapid Response Assessment Report*. Vienna: International Union of Forest Research Organizations (IUFRO).

Kusters, K., Achdiawan, R., Belcher, B. and Ruiz Pérez, M., 2006. Balancing development and conservation? An assessment of livelihood and environmental outcomes of non-timber forest product trade in Asia, Africa, and Latin America. *Ecology and Society* 11(2): 20.

Lama, A. S., Kharel, S. and Ghale, T., 2017. When the mean are away: migration and women's participation in Nepal's community forestry. *Mountain Research and Development* 37 (3):263-270.

Larson, A. M. and Soto, F., 2008. Decentralization of natural resource governance regimes. Annual *Review of Environment and Resources* 33: 213-239.

Laurance, W.F., Peletier-Jellema, A., Geenen, B., Koster, H., Verweij, P., Van Dijck, P., Lovejoy, T. E., *et al.*, 2015. Reducing the global environmental impacts of rapid infrastructure expansion. *Current Biology* 25 (7): R259-R262.

Lawrence, D. and Vandecar, K., 2015. Effects of tropical deforestation on climate and agriculture. *Nature Climate Change* 5: 27-36.

Li, T. M., 2010. Indigeneity, Capitalism, and the management of dispossession. *Current Anthropology* 51(3): 385-414.

Li, T. M., 2014. Fixing Non-market Subjects: Governing Land and Population in the Global South. *Foucault Studies* 18: 34-48.

Liu, J., Li, S., Ouyang, Z., Tam, C. and Chen, X., 2008. Ecological and socioeconomic effects of China's policies for ecosystem services. *PNAS* 105 (28): 9477-9482.

López-Feldman, A., Mora, J. and Taylor, J. E., 2007. Does natural resource extraction mitigate poverty and inequality? Evidence from rural Mexico and a Lacandona Rainforest Community. *Environment and Development Economics* 12(2): 251-269.

Lüdeke, M. K. B., Petschel-Held G. and Schnellnhuber, H. J., 2004. Syndromes of global change: The first panoramic view. *Gaia* 13 (1): 42-39.

Lund, J. F. and Saito-Jensen, M., 2013. Revisiting the issue of elite capture of participatory initiatives. *World Development* 46: 104-112.

Lundgren, B, 2015. *Forests and trees: their roles and opportunities in Africa's development, food security and environmental health.* Nairobi: African Forest Forum.

Macqueen, D.J., Dufey, A. and Patel, B. 2006. *Exploring fair trade timber: A review of issues in current practice, institutional structures and ways forward*. IIED Small and Medium Forestry Enterprise Series 19. Edinburgh: IIED.

Mansourian, S., Parrotta, J., Balaji, P., Bellwood-Howard, I., Bhasme, S., Bixler, R.P., Boedhihartono, A.K., *et al.*, 2020. Putting the pieces together: integration for forest landscape restoration implementation. *Land Degradation & Development* 31(4): 419-429.

Mbiti, I. and Weil, D. N., 2016. Mobile banking: The case of M-Pesa in Kenya. In: *African Successes, Volume III: Modernization and Development*, edited by S. Edwards, S. Johnson and D. N. Weil. Chicago: University of Chicago Press. 247-293.

McCarthy, D.P., Donald, P.F., Scharlemann, J.P., Buchanan, G.M., Balmford, A., Green, J.M., Bennun, L.A., *et al.*, 2012. Financial costs of meeting global biodiversity conservation targets: current spending and unmet needs. *Science* 338 (6109): 946-949.

McElwee, P., 2009. Reforesting "bare hills" in Vietnam: Social and environmental consequences of the 5 million hectare reforestation program. *Ambio* 38 (6): 325-333.

MEA, 2005. *Millennium Ecosystem Assessment, Ecosystems and Human Wellbeing: A Framework for Assessment*. Washington D.C.: Island Press.

Messina, J. P., Walsh, S. P., Mena, C. F. and Delamater, P. L., 2006. Land tenure and deforestation patterns in the Ecuadorian Amazon: Conflicts in land conservation in frontier settings. *Applied Geography* 26 (2): 113-128.

Meyfroidt, P., Lambin, E.F., Erb, K.H. and Hertel, T.W., 2013. Globalization of land use: distant drivers of land change and geographic displacement of land use. *Current Opinion in Environmental Sustainability* 5 (5): 438-444.

Meyfroidt, P., Chowdhury, R.R., de Bremond, A., Ellis, E.C., Erb, K.H., Filatova, T., Garrett, R.D., et al., 2018. Middle-range theories of land system change. Global *Environmental Change* 53: 52-67.

Millar, C. I. and Stephenson, N. L., 2015. Temperate forest health in an era of emerging megadisturbance. *Science* 349 (6250): 823-826.

Miller, D. C. and Hajjar, R. 2020. Forests as pathways to prosperity: Empirical insights and conceptual advances. *World Development* 125: 104647.

Miller, D. C., Rana, P., Nakamura, K., Forrest, S., Cheng, S. H., Ahlroth, S. E. and Perge, E. B., 2019. *A Systematic Review of the Impact of Forest Property Rights Interventions on Poverty*. Washington DC: World Bank.

Mogoi, J., Obonyo, E., Ongugo, P., Oeba, V. and Mwangi, E., 2012. Communities, property rights and forest decentralisation in Kenya: Early lessons from participatory forestry management. *Conservation and Society* 10 (2): 182.

Moran, E. F., 1990. Public and private colonization schemes in Amazonia. In: *The Future of Amazonia*, edited by D. Goodman and A. Hall. London: Palgrave McMillan. 70-89.

Mudege, N. N., Mdege, N., Abidin, P. E. and Bhatasara, S., 2017. The role of gender norms in access to agricultural training in Chikwawa and Phalombe, Malawi. *Gender, Place & Culture* 24 (12): 1689-1710.

Mukherjee, P., Ray, B. and Bhattacharya, R., 2017. Status differences in collective action and forest benefits: evidence from joint forest management in India. *Environment, Development and Sustainability* 19: 1831-1854.

Münster, U., 2014. Invisible Labor: Adivasi Workers in the History of South Indian Forest Conservation. In: *Asian Environments: Connections across Borders, Landscapes, and Times*, edited by U. Münster, S. Satsuka and G. Cederlöf, RCC Perspectives, no. 3, pp. 53-58.

Muscarella, R., Kolyaie, S., Morton, D.C., Zimmerman, J.K. and Uriarte, M., 2020. Effects of topography on tropical forest structure depend on climate context. *Journal of Ecology* 108 (1): 145-159.

Mutune, J. M., Hansen, C. P., Wahome, R. G. and Mungai, D. N., 2017. What rights and benefits? The implementation of participatory forest management in Kenya: The case of Eastern Mau Forest Reserve. *Journal of Sustainable Forestry* 36 (3): 230-249.

Naidoo, R., Gerkey, D., Hole, D., Pfaff, A., Ellis, A. M., Golden, C. D. and Herrera, D., 2019. Evaluating impacts of protected areas on human well-being across the developing world. *Science Advances* 5 (4): eaav3006.

Namubiru-Mwaura, E., 2014. *Land Tenure and Gender: Approaches and Challenges for Strengthening Rural Women's Land Rights*. Washington DC: World Bank.

Nellemann, C., Henriksen, R., Raxter, P., Ash, N. and Mrema, N., 2014. *The Environmental Crime Crisis: Threats to Sustainable Development from Illegal Exploitation and Trade in Wildlife and Forest Resources*. Nairobi: UNEP GRID-Arendal.

Nelson, V., Tallontire, A. and Collinson, C., 2002. Assessing the benefits of ethical trade schemes for forest dependent people: comparative experience from Peru and Ecuador. *International Forestry Review* 4 (2): 99-109.

North D. C., 1990. *Institutions, institutional change and economic performance*. London, New York and Melbourne: Cambridge University Press.

Oldekop, J. A., Bebbington, A. J., Hennermann, K., McMorrow, J., Springate, D. A., Torres, B. and Preziosi, R. F., 2013. Evaluating the effects of common-pool resource institutions and market forces on species richness and forest cover in Ecuadorian indigenous Kichwa communities. *Conservation Letters* 6 (2): 107-115.

Oldekop, J. A., Sims, K. R. E., Whittingham, M. J. and Agrawal, A., 2018. An upside to Globalization: International migration drives reforestation in Nepal. *Global Environmental Change* 52: 66-74.

Oldekop, J. A., Sims, K. R., Karna, B. K., Whittingham, M. J. and Agrawal, A., 2019. Reductions in deforestation and poverty from decentralized forest management in Nepal. *Nature Sustainability* 2 (5): 421.

Oldekop, J. A., Vang Rasmussen, L., Agrawal, A., Bebbington, A. J., Meyfroidt, P., Bengston, D., Blackman, A., *et al.*, 2020. Forest-linked livelihoods in a globalized world (*in review*).

Ordway, E. M., 2015. Political shifts and changing forests: Effects of armed conflict on forest conservation in Rwanda. *Global Ecology and Conservation* 3: 448-460.

Ostrom, E. 2009. A general framework for analyzing sustainability of social-ecological systems. *Science* 325 (5939): 419-422.

Pacheco, P., 2012. Smallholders and communities in timber markets: Conditions shaping diverse forms of engagement in tropical Latin America. *Conservation and Society* 10 (2): 114-123.

Pacheco, P., Cerutti, P. O., Edwards, D. P., Lescuyer, G., Mejia, E., Navarro, G., Obidzinski, K., *et al.*, 2016. Multiple and intertwined impacts of illegal forest activities. In: *Illegal Logging and Related Timber Trade: Dimensions, Drivers, Impacts and Responses: a Global Scientific Rapid Response Assessment Report,* edited by D. Kleinschmit, S. Mansourian, C. Wildburger and A. Purret. Vienna: International Union of Forest Research Organizations (IUFRO).

Pan, Y., Birdsey, R. A., Fang, J. Houghton, R., Kauppi, P. E., Kurz, W. A., Phillips, O. L., *et al.*, 2011. A large and persistent carbon sink in the world's forests. *Science* 333(6045): 988-993.

Pellegrini, L., 2011. Forest management and poverty in Bolivia, Honduras and Nicaragua: Reform failures? *European Journal of Development Research*, 23(2): 266-283.

Peng, H., Cheng, G., Xu, Z., Yin, Y. and Xu, W., 2007. Social, economic, and ecological impacts of the "Grain for Green" project in China: a preliminary case in Zhangye, Northwest China. *Journal of Environmental Management* 85 (3): 774-784.

Pérez, J. J. N. and Garzón, C. A. D., 2015. Inversión en el Posconflicto: Fortalecimiento institucional y reconstrucción del capital social. *Revista de Relaciones Internacionales, Estrategia y Seguridad* 10 (1): 203-224.

Persha, L. and Andersson, K., 2014. Elite capture risk and mitigation in decentralized forest governance regimes. *Global Environmental Change* 24: 265-276.

Persha, L., Agrawal, A. and Chhatre, A., 2011. Social and ecological synergy: local rule-making, forest livelihoods, and biodiversity conservation. *Science* 331 (6024): 1606-1608.

Phelps, J., Webb, E. L. and Agrawal, A,. 2010. Does REDD+ threaten to recentralize forest governance. *Science* 328 (5976): 312-313.

Piao, S., Fang, J., Zhou, L., Ciais, P. and Zhu, B., 2006. Variations in satellite-derived phenology in China's temperate vegetation. *Global Change Biology* 12 (4):672-685.

Piperata, B. A., Spence, J. E., Da-Gloria, P., Hubbe, M., 2011. The nutrition transition in Amazonia: rapid economic change and its impacts on growth and development in Ribeirinhos. *American Journal of Physical Anthropology* 146 (1): 1-13.

Platteau, J. P., 2004. Monitoring elite capture in community-driven development. *Development and Change* 35 (2): 223-246.

Potts, J., 2018. *State of Sustainability Initiatives Review: Standards and the Extractive Economy*. London: International Institute for Sustainable Development (IISD).

Poudel, D. P., 2019. Migration, forest management and traditional institutions: Acceptance of and resistance to community forestry models in Nepal. *Geoforum* 106: 275-286.

Prateek, G., Knopf, R. C. and Aggarwal, R. M., 2019. Impact of out-migration of men on women's participation in community-based forestry: insights from Van Panchayats of Uttarakhand, India. *International Forestry Review* 21 (2): 212-224.

Pulhin, J.M. and Ramirez, M.A.M., 2016. Timber regulation and value chain in community-based timber enterprise and smallholder forestry in the Philippines. *Forests* 7 (8): 152.

Putz, F. E., Zuidema, P.A., Synnott, T., Peña-Claros, M., Pinard, M.A., Sheil, D., Vanclay, J.K., *et al.*, 2012. Sustaining conservation values in selectively logged tropical forests: the attained and the attainable. *Conservation Letters* 5 (4): 296-303.

Rahut, D. B., Ali, A. and Behera, B., 2015. Household participation and effects of community forest management on income and poverty levels: Empirical evidence from Bhutan. *Forest Policy and Economics* 61: 20-29.

Reboredo, F., 2013. Socio-economic, environmental and governance impacts of illegal logging. *Environment Systems and Decisions* 33: 2950-394.

Ribot, J. C., 2002. Democratic decentralization of natural resources: institutionalizing popular participation. Washington DC: World Resources Institute.

Robson, J. P. and Berkes, F., 2011a. How does out-migration affect community institutions? A study of two indigenous municipalities in Oaxaca, Mexico. *Human Ecology* 39 (2): 179-190.

Robson, J. P., Berkes, F., 2011b. Exploring some myths of land use change: Can rural to urban migration drive declines in biodiversity? *Global Environmental Change* 21 (3): 844-854.

Robson, J. P. and Nayak, P. K., 2010. Rural out-migration and resource-dependent communities in Mexico and India. *Population and Environment* 32: 263-284.

RRI. 2017. *Tenure Data Tool*. Washington DC: Rights and Resources Initiative.

Rudel, T. K., DeFries, R. Asner, G. P., Laurance, W. F. 2009. Changing drivers of deforestation, and new opportunities for conservation. *Conservation Biology* 23 (6): 1396-1405.

Samii, C., Lisiecki, M., Kulkarni, P., Paler, L. and Chavis, L., 2015. *Decentralised forest management for reducing deforestation and poverty in low-and middle-income countries. Systematic Review 16*. London: International Initiative for Impact Evaluation.

Sánchez-Cuervo, A. M. and Aide, T. M., 2013. Consequences of the armed conflict, forced human displacement, and land abandonment on forest cover change in Colombia: A multi-scaled analysis. *Ecosystems* 16: 1052-1070.

Schlager, E. and Ostrom, E., 1992. Property-rights regimes and natural resources: a conceptual analysis. *Land economics* 68 (3): 249-262.

Schleicher, J., Peres, C. A., Amano, T., Llactayo, W., Leader-Williams, N., 2017. Conservation performance of different conservation governance regimes in the Peruvian Amazon. *Scientific Reports* 7 (1): 1-10.

Shah, Alpa 2010. In *the Shadows of the State indigenous politics, environmentalism, and insurgency in Jharkhand, India*. Durham and London: Duke University Press.

Shaw, R. P. 1989. Rapid Population Growth and Environmental Degradation: Ultimate versus Proximate Factors. *Environmental Conservation* 16 (3): 199-208.

Sikor, T., He, J. and Lestrelin, G., 2017. Property rights regimes and natural resources: a conceptual analysis revisited. *World Development* 93: 337-349.

Smirnov, D.Y., Kabanets, A.G., Milakovsky, B.J., Lepeshkin, E.A. and Sychikov, D.V., 2013. *Illegal Logging in the Russian FarEast: Global Demand and Taiga Destruction*. Moscow: WWF Russia

Somanathan, E., Prabhakar, R. and Mehta, B. S. 2009. Decentralization for cost-effective conservation. *PNAS* 106 (11): 4143-4147.

Song, C., Bilsborrow, R., Jagger, P., Zhang, Q., Chen, X. and Huang, Q., 2018. Rural household energy use and its determinants in China: how important are influences of payment for ecosystem services vs. other factors? *Ecological Economics* 145: 148-159

Song, C., Zhang, Y., Mei, Y., Liu, H., Zhang, Z., Zhang, Q., Zha, T., *et al.*, 2014. Forests Sustainability and China's Sloping Land Conversion Program (SLCP): A Comparison among Three Sites in Anhui, Hubei and Shanxi. *Forest Policy and Economics* 38: 161-167.

Stoian, D., Rodas, A., Butler, M., Monterroso, I. and Hodgdon, B., 2018. *Forest concessions in Petén, Guatemala: A systematic analysis of the socioeconomic performance of community enterprises in the Maya Biosphere Reserve*. Bogor: CIFOR.

Southgate, D., Salazar-Canelos, P., Camacho-Saa, C. and Stewart, R., 2000. Markets, institutions, and forestry: the consequences of timber trade liberalization in Ecuador. *World Development* 28 (11): 2005-2012.

Sunam, R. K. and McCarthy, J. F., 2016. Reconsidering the links between poverty, international labour migration, and agrarian change: critical insights from Nepal. *The Journal of Peasant Studies* 43 (1): 39-63.

Sunam, R. K., 2017. In search of pathways out of poverty: Mapping the role of international labour migration, agricultural and rural labour. *Journal of Agrarian Change* 17 (1): 67-80.

Sunderlin, W.D., Angelsen, A., Belcher, B., Burgers, P., Nasi, R., Santoso, L. and Wunder, S., 2005. Livelihoods, forests, and conservation in developing countries: An overview. *World Development* 33 (9): 1383-1402.

Sündstrom, A., 2016. Understanding illegality and corruption in forest governance. *Journal of Environmental Managament* 181: 779-790.

Taylor, M. J., Aguilar-Støen, M., Castellanos, E., Moran-Taylor, M. J. and Gerkin, K., 2016. International migration, land use change and the environment in Ixcán, Guatemala *Land Use Policy* 54: 290-301.

Tacconi, L., Cerutti, P.O., Leipold, S., Rodrigues, R.J., Savaresi, A., Phuc, T. and Weng, X., 2016. Defining Illegal Forest Activities and Illegal Logging. In: *Illegal Logging and Related Timber Trade: Dimensions, Drivers, Impacts and Responses: A Global Scientific Rapid Response Assessment Report*, edited by D. Kleinschmit, S., Mansourian, C., Wildburger and A. Purret. Vienna: International Union of Forest Research Organizations (IUFRO).

Tan-Soo, J. S. and Pattanayak, S. K., 2019. Seeking natural capital projects: Forest fires, haze, and early life exposure in Indonesia. *PNAS* 116 (12): 5239-5245.

Tiriviyi, N., 2017. *Social protection for building resilience of forest-dependent people: Evidence, linkages, practices, and potential applications. Social Protection and Forestry Working Paper 1.* Rome: FAO.

To, P. X., Dressler, W., Mahanty, S., Thuy, P. T. and Zingerli, C., 2012. The prospect for Payment for Ecosystem Services (PES) in Vietnam: A look at three payment schemes. *Human Ecology* 40 (2): 237-249.

Trumbore, S., Brando, P. and Hartmann, H., 2015. Forest health and global change. *Science* 349 (5250): 814-818.

Tubbeh, R. M. and Zimmerer, K. S., 2019. Unraveling the Ethnoterritorial Fix in the Peruvian Amazon: Indigenous Livelihoods and Resource Management after Communal Land Titling (1980s-2016). *Journal of Latin American Geography* 18 (2): 33-59.

UNECE/FAO, 2019. *Forest Products Annual Market Review*, 2018-2019. Geneva and Rome: United Nations Economic Commission for Europe (UNECE) / Food and Agricultural Organization of the United Nations (FAO).

Urrunaga, J. M., Johnson, A., Dhaynee Orbegozo, I. and Mulligan, F., 2012. *The Laundering Machine: How Fraud and Corruption in Peru's Concession System are Destroying the Future of Its Forests*. Washington D.C. and London: Environmental Investigation Agency.

van Mantgem, P. J., Stephenson, N. L., Byrne, J. C., Daniels, L. D., Franklin, J. F., Fulé, P. Z., Harmon, M. E., *et al.*, 2009. Widespread increase tree mortality rates in the western United States. *Science* 323 (5913): 521-524.

Vang Rasmussen, L., Coolsaet, B., Martin, A., Mertz, O., Pascual, U., Corbera, E., Dawson, N., Fisher, J. A., *et al.*, 2018. Social-ecological outcomes of agricultural intensification. *Nature Sustainability* 1: 275-282.

VanWey, L. K., Guedes, G. R. and D'Antona. Á. O., 2012. Out-migration and land-use change in agricultural frontiers: insights from Altamira settlement project. *Population and Environment* 34: 44-68.

Walker, A., 2004. Seeing farmers for the trees: Community forestry and the arborealisation of agriculture in northern Thailand. *Asia Pacific Viewpoint* 45 (3): 311-324

Watson, J. E. M., Dudley, N., Segan, D. B. and Hockings, M., 2014. The performance and potential of protected areas. *Nature* 515: 67-73.

Watson, J. E. M., Evans, T., Venter, O., Williams, B., Tulloch, A., Stewart, C., Thompson, I., *et al.*, 2018. The exceptional value of intact forest ecosystems. *Nature ecology & evolution* 2(4): 599-610.

Weiss, G., Emery, M.R., Corradini, G. and Živojinović, I., 2020. New Values of Non-Wood Forest Products. *Forests* 11 (2): 165.

Wiersum, K.F., Humphries, S. and Van Bommel, S., 2013. Certification of community forestry enterprises: experiences with incorporating community forestry in a global system for forest governance. *Small-scale Forestry* 12 (1): 15-31.

World Bank, 2020. Indicators – Open Data. Available at: https://data.worldbank.org/indicator [accessed on: 28 August 2020].

Xu, L., Samanta, A., Costa, M. H., Ganguly, S. Nemani, R. R. and Myneni, R. B., 2011. Widespread decline in greenness of Amazonian vegetation due to the 2010 drought. *Geophysical Research Letters* 38 (7): L07402.

Zhang, Q., Bilsborrow, R. E., Song, C., Tao, S. and Huang, Q., 2019. Rural household income distribution and inequality in China: Effects of payments for ecosystem services policies and other factors. *Ecological Economics* 160: 114-127

Zhou, L., Tian, Y., Myneni, R. B., Ciais, P., Saatchi, S., Liu, Y. Y., Piao., S., *et al.*, 2014. Widespread decline of Congo rainforest greenness in the past decade. *Nature* 509: 86-90.